ELECTRICAL REVIEW

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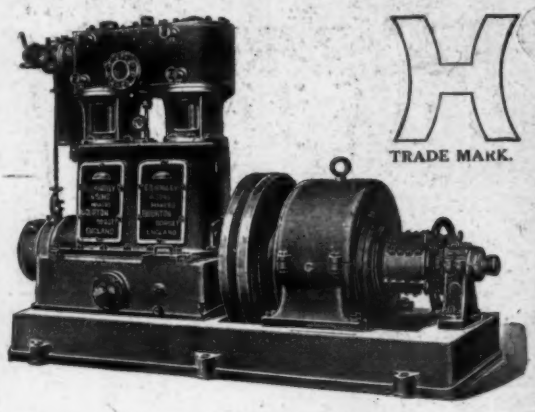

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RESEARCH WITH A BIAS.

THERE is now, and there has been for some time, a great deal of discussion of the attitude of the State and of the Nation (the terms are not synonymous) towards science, and particularly towards scientific research. We should like to believe that the nation so fully realised the value of knowledge that those who administered its affairs would be compelled to provide the fullest facilities for the gaining of knowledge, and the extending of its present boundaries. Yet who that has the subject seriously at heart can feel otherwise than discouraged when surveying the present situation? "Big Business" has its own ideas of the value of research for commercial reasons; scientific men are inclined to question the propriety of leaving a matter in which they rightly feel that they are considerably interested, entirely in the hands of those who will, in the first place, use the results obtained in their own, and not in the general interest.

Many large commercial concerns are spending large sums on the equipment of research departments, and there is no doubt that it is a good thing that it has at last been realised that we cannot hope to keep abreast of other nations unless we are constantly on the look-out for possible improvements in methods of manufacture. But that is not, and cannot be, the whole of the story.

"You will do well to make timely provision for an even greater development of scientific research. Looking round as we do upon a world devastated by the ravages of war, amazed at what it has accomplished, appalled at what it has lost, and concentrated in an endeavour to substitute for those old roads it may no longer travel wider and better-planned avenues of life, we pin our faith upon the possibilities emerging from the progressive application of science to the service of man."

These telling words were uttered by His Majesty the King on the occasion of his visit to the University of Edinburgh, and since it is reasonable to suppose that the views of a constitutional monarch are not out of accord with those of his ministers, there would seem ground for hoping that official circles recognised the urgency of the situation. It is in the endeavour to put these views into operation that the disparity between word and deed becomes manifest; and in this connection it may be observed that the whole attitude of the administrative mind as exemplified in the average M.P., town councillor, or official, towards educational matters, is the reverse of satisfactory, to say the least of it, even after the almost life-long endeavours of understanding men and women to dissipate the gloom in which such people surround themselves.

We recorded a few months ago the decision of the Manchester Municipal College of Technology to neglect its unequalled facilities for post-graduate work, in which research must necessarily play a large part, in order to admit students fresh from school who could equally well be accommodated at any of the excellent technical schools to be found in smaller towns in the north of England. In July we read of the decision of the Council of the City and Guilds of London Institute to close Finsbury Technical College mainly for the reason that they cannot afford to carry it on; and this in spite of valuable research work carried out there during the war. Did space permit, we could elaborate this theme; but for the moment we wish to deal with something else.

It may be replied that the State has founded a Department of Scientific and Industrial Research, as long ago as 1915. That is quite true, and when the Department was created it seemed as if the President of the Board of

Education appreciated properly, and fully understood, what was needed for success. It was recognised that the question was one in which the Universities were deeply interested, if only for the reason that from that source alone could be obtained the young men and young women competent to engage in research work. The money to be provided would have to be spent in training as well as in the research work itself, and therefore it would have to be spent partly in grants to the Universities, since, as already stated, they were to be the training grounds. Further, it was recognised that "a great part of all research will necessarily be done in Universities, which are already aided by the State." Moreover, it was provided that any discoveries made in the course of researches on which public money had been spent should be made available, under proper conditions, for the public advantage. Thus a new Department was created, and, what is more, a million sterling was provided to further the good work.

How far the Department has travelled from its original purpose is revealed by its fifth annual report, recently published. It has discovered that it is no part of its duties to assist the Universities; that in spite of the increased and increasing cost of producing and distributing the *Journals* of scientific societies, any grant made either for the purpose of paying part of the cost or by way of reduced postal charges is on all-fours with the coal subsidy, the railway subsidy, or any other of the charges with which the nation was obliged—or thought it was obliged—to saddle itself during the war. It has preferred to assist the establishment of a number of Research Associations, in the interests of different industries, financing them, out of the million pounds already mentioned, to the extent of not less than pound for pound; in the case of the British Glass Research Association, the assistance afforded is at the rate of three pounds to one.

The discoveries made by the workers engaged in research under the auspices of these associations remain the property of the associations in question, the State having no property rights in them, although it helps to pay for them. The researcher himself renounces all his personal freedom, and becomes a paid employé of the association, trusting only to "the adoption of an enlightened and generous policy by the association" (we quote the Department's own words) for recognition. Knowing what we know of the reward of initiative and inventiveness on the part of those employed by manufacturing concerns at the present time, we candidly say that we do not believe that the associations will behave any better in this respect than the individual firms composing them have been in the habit of doing in the past.

By some means or other, then, the original and entirely laudable aims with which the Department was inaugurated have become warped in favour of the interests of commerce and to the prejudice of the no less important interests of science. The subsidising of trade, so unctuously objected to in the case of the scientific societies, becomes a virtue, to whose development every taxpayer must contribute, when great trading corporations are involved. The intervention of the State in this matter does not seem to have been attended with the happiest results.

A remedy advocated by Prof. Frederick Soddy, F.R.S., in *The Observer* for September 26th, was for the Department of Education to resume control of the original scheme, leaving such reseaches as must, in the national interests, be kept secret, such as those on behalf of the Navy and the Army, to the Government departments concerned. We permit ourselves to doubt whether even the Department of Education would inevitably and invariably deal with such matters in a spirit of true enlightment.

The whole question is one of exceeding difficulty, but there is no doubt that at present we are definitely on the wrong road. Much greater freedom and assistance must be given to the Universities and to the scientists of the country. We have always found it to be true that a real scientist or a real engineer will make a much better job of anything he is entrusted with, than a so-called "practical man" or "business man" without scientific assistance. And in this matter, as in others, we are inclined to pin our faith to the scientist and not to the commercial "Research Association."

The London Electricity Supply Problem.

Following our leaders on this subject, and our reference to the probable long delay there must be before any final scheme embracing all London can be put into operation, we think it is not fully appreciated how lengthy and complicated a matter the formation of a Joint Electricity Authority for London must necessarily be.

The Electricity (Supply) Act, 1919, provides for the constitution of such an Authority "representative of authorised undertakers within the electricity district, either with or without the addition of representatives of the Council of any county situate wholly or partly within the electricity district, local authorities, large consumers of electricity, and other interests within the electricity district." Now, consider numerically what elements are here involved. In the London area as delimited provisionally by the Electricity Commissioners, there are 40 municipal undertakings and 41 company undertakings. The total of local authorities (including the above 40) comes to about 156. Then there are eight County Councils: London, Middlesex, Kent, Surrey, Hertfordshire, Bucks, Berks, Essex. Further, the matter is especially complicated in respect of the comparative interests when we consider its financial and political side. The London County Council has powers of purchase over the 13 London companies, and therefore will be a preponderating element in the Authority. But this needs an adjustment between the L.C.C. and the municipal undertakings in London and the County Councils outside. Then certain local authorities in Extra-London have a special interest in view of their purchasing rights over the companies in their areas. The large consumers (railway companies and so forth) are also an item, but in view of the above larger factors, they can be ignored. In the past all these conflicting interests have constituted an insuperable obstacle to anything being achieved.

In the Technical Report adopted by the L.C.C. in April, 1914, referring to a "combination of all existing authorities," it states: "This method may be briefly dismissed . . ." "At the present time there is not sufficient cohesion among either the companies themselves or the borough councils, and still less among all the authorities in Greater London, to form even the nucleus of such a body. The unfortunate absence of agreement among the various undertakers militates both against their own interests and the electrical interests of London as a whole."

Whether better counsels prevail to-day we cannot say. The evidence up to the present indicates the reverse. The last published reports of the views of the local authorities on the subject revealed anything but a friendly attitude towards the companies. Among the companies themselves the lack of unanimity on any concrete common measure is too well known for comment. Such then being the present position, it justifies, we think, the general misgiving that unless the Electricity Commissioners get some steps taken, one way or another, while this Joint Authority is being set up, the case of London will be nearly as hopeless as ever.

The Germans and Swiss Investment Companies.

It is now many years since the big electrical manufacturing firms in Germany conceived the idea of the indirect creation of supply works and tramways in most countries in Europe, with the object of securing these undertakings as their permanent customers for machinery and plant. The scheme took the form of the establishment of combined investment and promotion companies in Germany and in Switzerland, which participated, in conjunction with the banks and banking firms, in the constitution of electricity supply and tramway companies in different countries. Some of the German companies raised loans in Swiss currency in Switzerland, with interest payable in Swiss francs, and the loans eventually redeemable in the same currency. The necessity for meeting the interest charges in this manner has recently become a source of embarrassment in Germany, owing to the heavy depreciation of the mark. On the other hand, the ramifications of interests of the Swiss companies have been more widely distributed over Europe than in the case of the German investment com-

panies, and with the decline in the currencies of these countries and the entire cessation of income from Russia, the position of the Swiss concerns has become unfortunate, as the receipts from most of the countries concerned, when converted into Swiss currency, only represent a small percentage of what they formerly received when dividends on shares or interest on loans or advances were paid at the pre-war rates of exchange.

We referred recently to the fact that the enormous losses on exchange had compelled the Zurich Bank for Electrical Undertakings to propose a scheme of financial reconstruction, and it is well to bear in mind that this investment company was formed at the instance of the Berlin A.E.G. Now the Swiss Electrical Industry Co. (Schweiz. Gesellschaft fur Elektrische Industrie), of Glarus (late Basle), which is the trust company for the Siemens and Halske group, and was constituted in 1896, is under the necessity of proceeding with a scheme of reorganisation also in consequence of losses on exchange. The company, which has an ordinary share capital of 20,000,000 fr., and loans amounting to 60,000,000 fr., reports a loss of 43,730,000 fr., according to the balance-sheet prepared in October. This loss is covered by "exchange guarantees" to the extent of 25,490,000 fr., and is further reduced to 14,740,000 fr. by the absorption of the reserve funds, &c. It is now proposed to reorganise the company by reducing the share capital from 20,000,000 to 4.000,000 fr., and by the conversion of the loans into cumulative preference shares of the same amount.

It is understood that the German manufacturing companies concerned still have an interest in the two investment companies in question, although the participation held in the Bank for Electrical Undertakings by one firm was curtailed a number of years ago. As, however, the big firms have received indirectly plenty of orders in the course of years from the foreign companies controlled by the investment companies, there is no reason for assuming that their interests will materially suffer from the reorganisation schemes now under consideration in Switzerland.

A Selfish Policy.

The City of Bath has always been a lover of tradition. It is a pity that on the occasion which we are about to mention the city does not feel that a policy of generous help is more in accordance with its good traditions than a policy of mere obstructionism. The case we refer to is the formation of the West of England Electricity Authority to cover the district which has been delimited by the Electricity Commissioners. In this area Bath will be one of the chief factors. From the inception of the scheme, Bath has been a dead weight. It seems that the Electric Lighting Committee has now recommended the Council not to confirm the resolutions passed at the Conference of all undertakers when it was decided to establish a Joint Authority. The ground for this is that Bath thinks it better to wait until the Electricity Commissioners have held their local inquiry, when the degree of liability that Bath will have to assume may be more clearly defined.

It is just as though Bath said: Form a Joint Electricity Authority leaving us out. If there are any risks, let the other people take them—we will stand out until the scheme is an assured success, then we shall have no objection to coming in and taking a share of the advantages, but we are certainly not going to share any risks.

Such an attitude is not only disloyal to the district, it is disloyal to the whole country, seeing how much our industrial prosperity will depend upon the improvement of electricity supply in the country, which in its turn largely depends on the formation of these Authorities. The attitude of Bath is the more iniquitous in that it is not only delaying the formation of the Authority, but it is stopping immediate work on transmission lines which we understand the Ministry of Transport would be prepared to proceed with if the local authorities, including Bath, all agreed forthwith to form the joint authority. The transmission lines in question which are thus hung up have an important bearing on immediate industrial development. One of the areas which would be affected would be the Stroud Valley. Now, in the Valley there are at present a number of industries, and if a supply of electric power were available, not only could these develop but there would be every likelihood of encouraging other suitable industries to settle in the district. Such plans fall in with the Reconstruction Committee's proposals for the revival of industries in rural or semi-rural districts where ideal conditions of living are attainable.

Again, as a subsidiary point, the immediate starting of any such work would help greatly in the present crisis of unemployment. Everything is to be gained, therefore, by going ahead, and it does seem that the Bath Corporation should be under the severest censure for blocking the way. Against this attitude of obstructionism we have always, as a journal, raised our voice. It has been the greatest hindrance to the industry throughout its history, but we live in hope that public opinion will sooner or later make it too unpopular a policy to be frequently adopted.

I.E.E. Informal Meetings.

The "Informal Meetings" commence again on Monday next, when the President will open a discussion on "Specialisation." These meetings afford excellent opportunities for the more retiring members of the Institution to practise the art of debate, without fear of unpleasant consequences, and the discussions are generally lively and well-sustained. It is to be hoped that they will be marked by good attendances this session; so many members are within range in the London area that there ought to be no difficulty in securing a "full house."

Obligation Week.

Yesterday, in common with our Allies, with solemn mien but thankful hearts, we celebrated the Victory over our enemies by paying a heartfelt tribute to the ever-glorious memory of the men by whose unwavering courage and heroic self-sacrifice that Victory was won; proud of their triumph over the terrors of Death—sorrowful because they have passed beyond our ken, to realms where our gratitude cannot reach them, and our debt to them can never be discharged. Faithful to the end, they did their duty.

Is there indeed no way in which we can, in some degree, display our gratitude and do honour to their memory? Have *we* no duty to perform, no obligation to discharge?

Not all who went forth to battle found peace and rest in the grave; millions came back to resume their struggle for a livelihood in a land that was to be "fit for heroes to live in," and alas!—with shame we say it—hundreds of thousands are still denied the opportunity to earn their daily bread. Yet their record falls short of that of those others whom we mourn in only one respect—that they had not the good fortune to fall on the field of battle. Spared by unkindly fate, they were thrown upon the tender mercies of their countrymen for whom they had fought and bled—and by them they were spurned. Is this the way in which we keep faith with those who gave their lives for us?

Nearly 300,000 men returned from the war are unemployed. Of these, some 20,000 men are blinded, maimed, or otherwise disabled. What are we going to do about it?

Let us all realise that the presence of these men amongst us affords us a Heaven-sent opportunity to pass from words to deeds—to honour our glorious dead in the persons of the glorious living. In the words of our gallant Prince: "Our debt of honour will not be fully paid until all the men who have come back—many of them, alas, disabled—have been given a proper chance of making good on their return to civil life." That is our great and solemn obligation; there lies our duty, and there should lie our pride—to do to these as we would gladly do to those who fell if we were able. Are we to be found wanting in this simple duty, where they were faithful in the far greater sacrifice? Never let this sin be laid to our charge. That this thing should have happened is our shame; that it should continue were disgrace unspeakable. Let us make this our first and most abiding care—to see that every ex-Service man is found a suitable job before the month is out.

A LARGE TOTALLY-ENCLOSED DYNAMO.

By ERNEST G. SANFORD.

THE writer proposes briefly to describe a totally-enclosed (gas tight) dynamo of 84-KW. capacity, and running at 210 R.P.M., recently installed in the Minehead Electricity Supply Co.'s power station. In the absence of any information to the contrary, it is believed that this is the largest output obtained from any totally-enclosed dynamo so far constructed in this country.

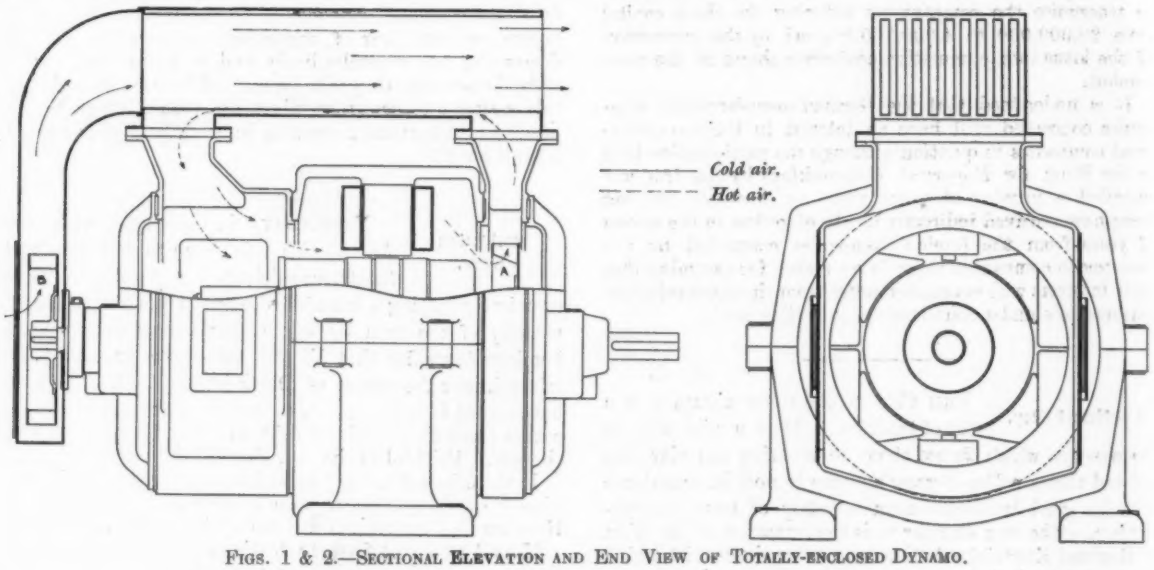
It is well known that one of the greatest enemies of dynamo electric machinery is producer gas, and many failures of generators have been traced to its presence.

It is practically impossible to prevent the gas being present, as leakage easily occurs from the engine glands, stuffing boxes, and in other ways. A particularly weak spot in the dynamo is the space behind the commutator risers. In addition to the dust, which in ordinary circumstances readily accumulates there, there is the effect of the gas, and the combination of the evils forms a means which eventually short-circuits some of the commutator sections. Not only is the insulation of the windings very seriously lowered, but the metal parts suffer severely, resulting in sparking and overheating of the commutator, with ill effects on the other contacts. Any practical scheme which will overcome these very serious drawbacks will, it is hoped, prove of interest to users and prospective users of this class of machinery.

Early in 1919 additional plant was necessary at the Minehead power station. It was then that the writer decided to secure a gas-tight machine if it could be obtained at a reasonable price. A number of well-known makers were asked to tender for such a machine, but only one firm, Messrs. Newtons, Ltd., of Taunton, put forward a machine which was guaranteed to fulfil the conditions of the specification. The underlying principle of the machine supplied will readily be seen from figs. 1 and 2, which is now Messrs Newtons' standard design for totally-enclosed machines with outputs up to 30 KW.; full views are shown in figs. 3 and 4. The actual construction of the machine as built for the Minehead station was modified somewhat to suit the larger output.

The method of dissipating the heat is an extremely simple one. A fan A situated within the machine is carried on the engine end of the armature shaft, and forces the hot air from the machine through a heat dissipator arranged in the form of a superstructure, and consisting of airways having thin metal walls arranged to present a large cooling surface. At the commutator end of the machine a second fan B is mounted on the armature shaft, and supplies cooling air, which is forced through the dissipator in alternate airways, but without intermixing with the heated air. A most efficient and effectual means is thus provided for abstracting the heat from the machine. The transverse section of the machine shown in fig. 2 clearly indicates the arrangement of the alternate hot and cold airways. The rated output of the Minehead dynamo is 280/220 volts, 300 amperes, at 210 R.P.M.

The dynamo is of Messrs. Newtons' well-known standard type, having magnets arranged in pairs, each pair being connected by a yoke of considerably less cross section that the main yoke, and to the smaller-section yoke is attached an interpole. The number of interpoles is, therefore, half the number of main poles, a type of construction which was originated eleven years ago by Mr. J. W. Burleigh, and was described in this journal at that time.*



FIGS. 1 & 2.—SECTIONAL ELEVATION AND END VIEW OF TOTALLY-ENCLOSED DYNAMO.

After erection on site a 6-hours' test run was made with the following results:—

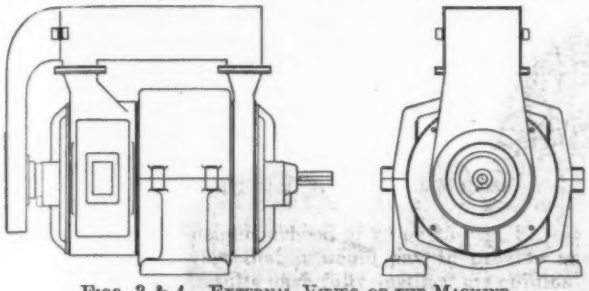
Time: 3.30-4.30-5.40-6.40-7.30-8.30-9.30 p.m.
Volts: 252-248-248-246-250-270-267.
Amps.: 300-275-280-300-300-310-310.
Speed: 192-192-195-192-192-192-192 R.P.M.

The measured commercial efficiency at full load was 90.5 per cent., and at half load 88 per cent. The dynamo was designed to run at a speed of 210 R.P.M., but the engine for certain mechanical reasons was adjusted to run at the above-recorded speeds. At the end of the 6-hours' run the temperatures were immediately taken, the figures being as under: Armature, 143 deg. F.; main field coils, 144 deg. F.; interpole coils, 150 deg. F.; commutator, 128 deg. F.; the temperature rise being: Armature, 61 deg. F.; main field coils, 62 deg. F.; interpole coils, 68 deg. F.; commutator, 46 deg. F. The maximum temperature rise after the 6-hours' run was, therefore, 68 deg. F., against the maximum figure of 82 deg. F. guaranteed by the makers. The general characteristics of the machine are excellent, and subsequent lengthy runs, sometimes of 18 hours' duration, have proved the machine to be satisfactory under all conditions of operation.

Reference to the general view of the machine, fig. 5, will show that the fan B draws cold air from outside the building through an intake duct. It is not, how-

* ELEC. REV., Nov. 26th, 1909, and Jan. 5th, 1912.

ever, by any means essential to provide such a cool-air supply for the dissipator; in fact, there would be little use in doing so unless there is a considerable difference in the air temperature between such supply and that within the building. The machine at Minehead was specified to work within a temperature rise of 82 deg. F. without air being supplied from the outside atmosphere. As, however, the difference in the air temperature between the inside and the outside of the Minehead



Figs. 3 & 4.—External Views of the Machine.

station is in the neighbourhood of 20 or 25 deg. F., the writer held the view that it would pay to provide an intake duct, and results have fully justified his opinion. The comparatively slight extra expense (which was approximately 6 per cent. of the total cost of the machine), in addition to the more effective ventilation of the station, lowers the temperature rise of the dynamo quite 8 deg. F., and increases the overload capacity by 10 per cent.

There is another fairly obvious point in connection with the ventilation which arises when a cold-air intake is provided. By suitably increasing the dimensions, and possibly the type of fan B, a larger volume of air can be obtained with very little extra initial outlay, or running costs. Again, in the case of low-speed plant the outside fan could easily be geared to run at a much higher speed to increase the air volume. The required volume of cold air could be passed through the heat dissipator, and by means of a suitably arranged output port, or ports, the additional volume of air over and above that required for the dissipator could be discharged direct into the engine room purely for ventilating purposes. In the writer's opinion this would form a most attractive and economical ventilating scheme, which would be capable of many modifications, and would be duly appreciated by the station staff.

Dynamos operating in buildings in conjunction with oil and steam engines are not entirely unaffected. The atmosphere is often heavily charged with oil vapour from the engines, while users of machines which are steam driven often experience trouble with the insulation where highly superheated steam is employed. Oil in suspension, in the form of vapour, has a marked deteriorating effect on the insulation of electrical machinery, and also the commutator. The vapour passes down through the commutator risers, and there unites with the carbon dust, forming conducting paths at points where the deposits have the lowest resistance, thereby reducing the insulation resistance. The writer believes that totally-enclosed dynamos can be advantageously used under these conditions also.

A point which it is well to bear in mind is that the purchaser of this class of electrical machinery would be certain to obtain the highest possible efficiency, as it is obvious that with totally-enclosed machines the designer would naturally reduce his losses to a minimum, in fact, it would be essential for him to do so. A further point of interest is that the temperature rise of this type of dynamo can be predetermined within the same fine limits as in the ordinary open type machine.

The initial cost to the purchaser of totally-enclosed heat-dissipating dynamos over the ordinary open type is approximately 25 per cent. This must be considered a small outlay for such obvious advantages.

The writer would like to explain to those whose experience in these matters is limited that he would never advise the consideration of machines in which the cooling air is forced directly into the machine by the method known as pipe ventilation. Of course, with such machines if the air is passed through a cleaning process the conditions are somewhat improved, but given time, in nine cases out of every ten, eventually the machines become veritable dirt traps.

The writer understands that the original design for the double-fan dissipator was patented by Mr. J. W. Burleigh, chief electrical engineer to Messrs. Newtons, Ltd., Taunton, but that since the design was prepared for the Minehead machine, Mr. Burleigh has laid his patents beside the "Lo-Thermo" ones of Messrs. Electromotors, Ltd., of Manchester, and this firm will doubtless be happy to supply makers, or prospective users, with further particulars relating to its valuable patents.

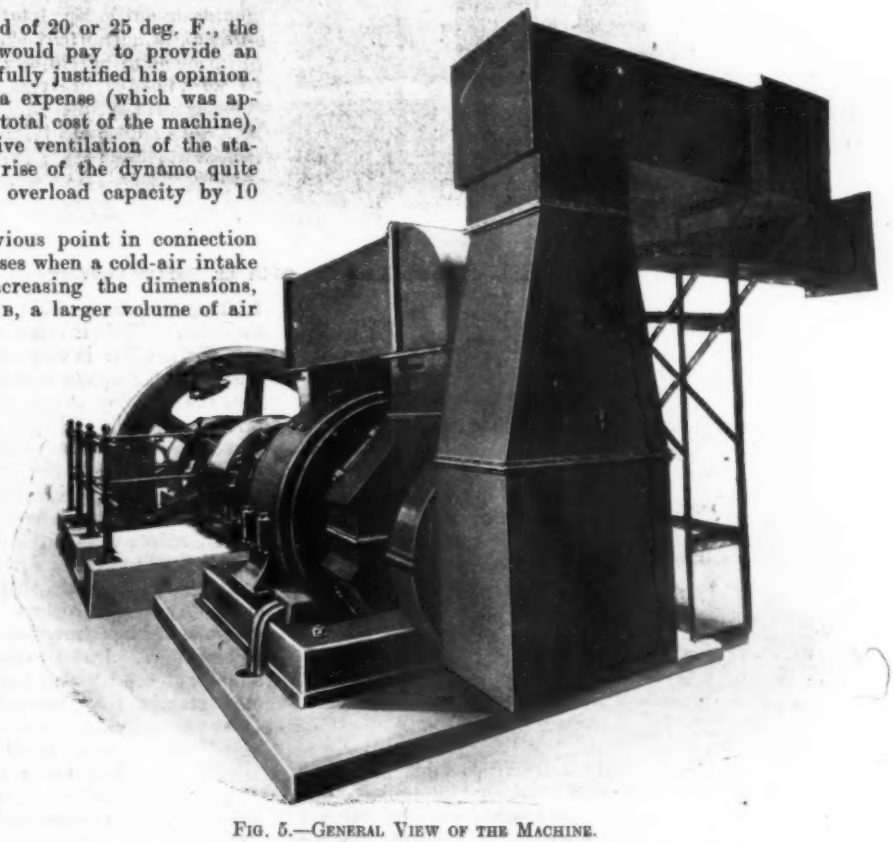


Fig. 5.—General View of the Machine.

Electrical Suburban Contractors' Association.—At Newtown, Sydney, N.S.W., recently, it was decided to form an Electrical Suburban Contractors' Association, its objects being to protect and foster the electrical trade and to approach Parliament with a view to the licensing of wiremen; also to endeavour to fix and maintain a minimum charge for electrical installations with regard to the various fluctuations of the market. A large number of electrical contractors were present, representing all the suburbs, and the motion to form an association was carried unanimously.—*Sydney Evening News.*

THE SHIPBUILDING, ENGINEERING AND ELECTRICAL EXHIBITION.

Although, in the title given to the Exhibition at Glasgow, electricity appears last, electrical apparatus and processes loom very large in the very excellent display which opened at the Kelvin Hall on Monday last, November 8th. The Kelvin Hall is an ideal building for exhibitions on a large scale, possessing as it does a total floor space of 200,000 sq. ft. and 2½ miles of passages between stands. It is particularly well illuminated, and although an abundance of lights is not always a guarantee of good lighting, it is interesting to note that a total of 100,000 c.p. is obtained by means of 2,000 electric lamps. Not only from the exhibitors' point of view is the place extremely satisfactory, but also the comfort and convenience of visitors have been fully studied. There are dining-rooms capable of seating

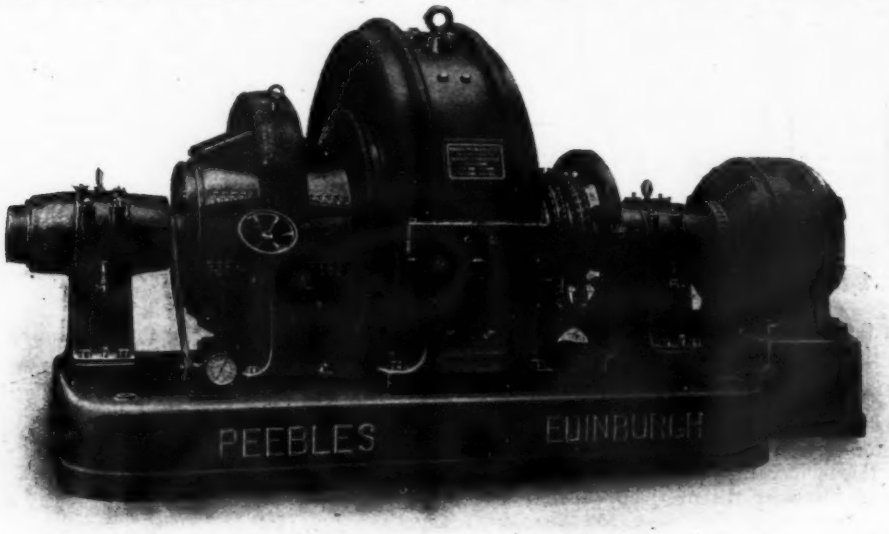


Fig. 1.—Peebles 1,500-kw., 25-Cycle, Rotary Converter.

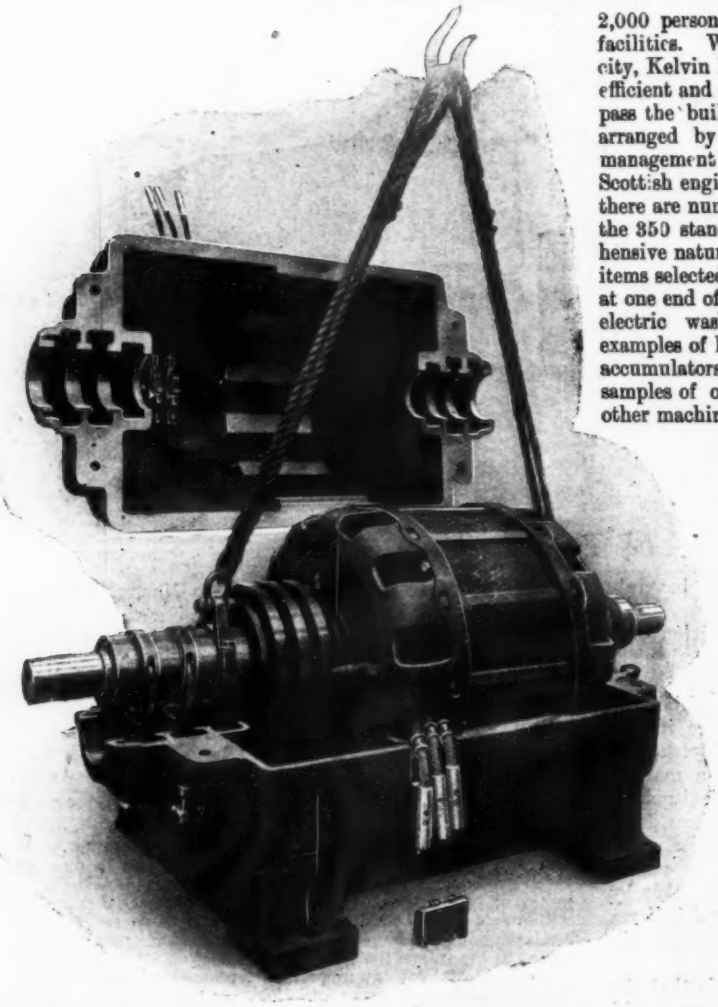


Fig. 2.—Peebles 40-b.h.p. Motor, Showing Method of Slinging

2,000 persons at one time, as well as telephone and postal facilities. While it is not near the business centre of the city, Kelvin Hall is very easily reached by the Corporation's efficient and frequent tramway service—more than 250 cars pass the building every hour. The exhibition has been arranged by the Glasgow civic authorities under the management of Mr. James M. Freer. Almost every Scottish engineering firm of standing is represented, and there are numerous exhibitors from South of the Border in the 350 stands which make up the whole. The comprehensive nature of the exhibition will be obvious from a few items selected at random from the official guide. Starting at one end of the scale, there are many domestic appliances, electric washers, cookers, &c., and at the other end examples of large converters. There are telephone exhibits, accumulators, Diesel engines, time-recording devices, samples of oil, lifeboats and yachts, planing machines and other machine tools, box-making machines, boilers, pressure gauges and tachometers, mechanical calculators, welding plants, &c. (A Glasgow firm has a confectionery exhibit.) The exhibition is open to the public from 10 a.m. to 10 p.m. up to December 4th.

Upon entering the hall, one's attention is immediately attracted by the stand occupied by Messrs. Bruce, Peebles & Co., Ltd., of Edinburgh. This firm has two good examples of the machines for which it is noted. The larger (fig. 1) is one of 12 machines being made for the Glasgow Corporation. It is a 1,500-kw. rotary converter running at 375 r.p.m. The a.c. side is built for a three-phase, 25-cycle supply, and the d.c. side produces current at 500/540 volts. A number of these have already been delivered to the Corporation, while the remainder are still in course of manufacture. The other large exhibit is a 500-kw. motor converter made to the order of the Mersey Docks and Harbour Board, and is one of six being constructed by the firm. The a.c. supply is three-phase, 25 cycles at 5,800/6,200 volts, and the machine, running at 750 r.p.m., gives

450/480 volts at the D.C. end. It has been found that the ordinary type of motor is unsuitable for the severe conditions obtaining in steel-works operation. Messrs. Bruce Peebles have, therefore, produced a range of A.C. and D.C. motors for iron and steel works, and a sample is shown on the stand. This is a 40-B.H.P. slip-ring type motor (fig. 2), and is one of a number manufactured for the Lanarkshire Steel Co., Ltd. Although these machines are, of course, more expensive than ordinary motors, there is a great and growing demand for them. The remainder of the exhibits of this firm consists of samples of Peebles standard industrial A.C. and D.C. motors, high-pressure windings, insulation, &c., the whole making up one of the most interesting and imposing stands in the Exhibition.

Domestic electrical apparatus finds a place among the larger exhibits. The Corporation itself has a well-arranged stand with examples of labour-saving devices and heating apparatus, while private firms whose exhibits are mainly of this nature are Messrs. Simplex Conduits, Ltd., who show a complete ship's installation for lighting, heating, and cooking; the Electric Appliances Co., Ltd., exhibiting the Imperial-Eureka electric vacuum cleaner; the Falkirk Iron Co., Ltd., a 10-kw. cooker, fires, heater, kettles, and irons; Messrs. Archibald Low & Sons, Glasgow, cooking, &c., apparatus for ships; and the James Keith and Blackman Co., Ltd., marine heater units, fans, &c.

(To be continued.)

THE INSTITUTION OF ELECTRICAL ENGINEERS.

Liverpool Sub-centre of the North-western Centre.

At the opening meeting of the 1920-21 session on November 1st, held at the University, Mr. H. Dickinson, M.Inst.C.E., M.I.E.E., M.I.M.E., delivered the chairman's address, an abstract of which follows:—

It certainly looks as though further powers will have to be granted by Parliament before the ideas propounded in the Electric Power Supply Report, 1918, by the Sub-committee of the Coal Conservation Committee can be carried fully into effect. It is hoped, however, that all undertakers will appreciate that the electricity supply existing to-day in this country needs modification, and that they will look at the matter in the broadest possible way, and co-operate with each other and with the Electricity Commissioners in order that electrical development, which is so essential to the industrial needs of the country, may be guided along those lines which will afford the greatest benefits to the community.

It is very satisfactory to notice at the present time the great strides that are being made in the design of plant and apparatus in all directions, and there is little doubt that those responsible for such improvements will be capable of meeting the necessities of the larger developments immediately ahead of us. The electrical industry has now arrived at a point where a certain huge demand awaits development. This great potential demand, which in the national interest must be provided for, cannot in the best interests of the country be adequately catered for by the patchwork system at present existing. Electricity by reason of the experience gained by its use in past years has proved to be the most convenient and adaptable form of power; and it is safe also to say that electricity is the cheapest form of motive power. The altered conditions due to the high cost of labour make it desirable to install labour-saving apparatus wherever possible. The tendency also to improve the conditions of labour, and to ameliorate the hardships which attend many duties which labour is called upon to fulfil will most certainly lead to the installation of the most up-to-date machinery, which will enable the men employed to effect greater production, and tend to develop the resources of the country for the general benefit of the community. Let us, then, deal with this matter in a bold and comprehensive manner, when I venture to predict that in the very near future we shall look upon the state of development to-day, great as it is, much as we to-day look upon the state of development of twenty years ago.

An essential feature to enable the proposals embodied in the Electric Power Supply Report to be carried out would be the use of cables capable of withstanding very much higher pressure than has been feasible in the past. The dielectric strength of the paper and compounds of which cables are composed is very high, and if it were not for other considerations it would be possible to make cables satisfactory for working at very high pressures. Unfortunately the admixture of air in the insulating materials has a very detrimental effect. When the air is stressed to the breakdown point ozone is formed which attacks the material of which the insulation is composed, and deterioration takes place. The action may be slow, but still there is the danger that gradual deterioration may take place and failure result.

The efforts of the cable makers have, therefore, been directed to effect the elimination of the air in the course of manufacture, and great improvements on these lines have been made. It is now claimed that it is possible by new methods to so far eliminate the amount of air enclosed in the insulation that it may be safely ignored. The elimination of air has also the effect of reducing the dielectric losses in the cable, and it may now be claimed that the dielectric loss in a super-pressure cable can be kept within such limits as not to be a material factor.

It must be admitted that this is a great step forward, and has a very important bearing on the question of supplying the larger districts by underground super-pressure cables, or by a combination of underground cables and aerial lines. It is gratifying to know that cable makers are prepared to-day to supply cables for working at 66,000 volts, and that at the present time a considerable quantity of cable is in course of manufacture for working pressures of 33,000 and 55,000 volts. It is only natural that manufacturers should wish for the time being to work on the conservative side, but as actual experience is gained, we may hope to see still further improvements.

Therefore, with the large demand which is assured with the proposed larger areas of supply, and with the cable available for working at the necessary higher pressures, the advisability of concentrating generation becomes apparent where favourable sites can be found. If a site fulfilling the requisite conditions and reasonably placed as regards the load can be found, there is no doubt that with the present knowledge a station can be built which will show a very great saving in the cost of generation. When these schemes are in operation, that is, when one authority controls the electricity supply over a large district, the electrification of the railways will be materially facilitated. As the various existing undertakings are linked up with super-pressure cables the transmission mains will pass through districts which could be tapped on the way, and many areas will be able to obtain a supply which otherwise would not be the case. Any waste heat in the district could be utilised for the generation of electricity, and the electrical energy so provided could be delivered into the transmission mains. In the past there has always been a certain quantity of unmarketable fuel which it would be possible to utilise if a super-pressure network of mains were in existence. The useful chemical products in the coal could be extracted, and the gases utilised for the production of electricity, or the coal could be utilised in a pulverised form for the generation of electricity. When considered from a national point of view, it must be admitted that the saving of coal, the assistance afforded by an extended supply towards the electrification of the railways, and the widening of the electrified area, must have a very beneficial effect.

These various advantages cannot be secured without the laying down of a super-pressure interlinking network, and it is difficult to see how this can come about unless the whole district, so far as generation and main transmission are concerned, comes under one authority. The principle of unity of control in each electrical district is the essential feature of the whole scheme, the necessity for which is so emphatic.

Those in authority will naturally consider that in the early stages after the formation of a Joint Electricity Authority the expenditure will be very heavy, and it will be a considerable time before the initial expenditure is fully remunerative. In some cases on this account there may be hesitation in embarking on these large and comprehensive schemes. If, however, during the initial period arrangements were made whereby money could be provided by the Government at a low rate of interest, or with an extended loan period, it would very materially assist the development of, and would be an undoubted encouragement to, the various authorities to enter whole-heartedly into, the new proposals.

There is no doubt whatever that owing to prevailing high prices it is most desirable to minimise all unnecessary expenditure at the present time. In considering this very important and complex problem, it is essential that the matter should be looked at, not from the point of view of the immediate future, but rather that of the position that will arise five or ten years ahead, and certain important facts must be taken carefully into consideration:—

(1) At the present time all undertakings are receiving applications for supply at an unprecedented rate. (2) Undertakers have been clamouring to be allowed to add additional generating plant. Where extensions have been allowed the plant will only provide for the needs for a very short period, so that additional plant will be required at an early date. (3) In some cases authorities are forced to take a supply from their neighbours who have extended their plant, which will bring nearer the time when these favoured authorities will have to renew their applications to the Commissioners. (4) Some of the stations where permission to extend has been granted are incapable of further development, and new stations will have to be built if the demand is to be catered for. (5) The sum total of these various additions is likely to be considerably greater than would be the case if the undertakings were linked together under one control. (6) The total capital expenditure on plant laid down by the various individual undertakings over a period of five or ten years is likely to be considerably greater than would be the case under a system such as has been proposed. (7) Under the present system of multiple control, the development is likely to be slower, and when railway electrification comes along the separately owned stations will be unlikely to be able to cater for the require-

ments. The probable result would be that the railway companies would have to build generating stations for their own use, and the improvement of diversity factor due to the railway demand would be lost to the supply authorities.

These are some of the problems that authorities must take into serious consideration when coming to a conclusion on the advisability of forming a Joint Electricity Authority.

Most certainly high costs are a serious drawback to the electricity supply industry, but not many people connected with the electrical industry would argue that the very large demands that undertakers have applications for at the present time should be ignored, and that owing to the high costs it is undesirable to install plant to meet these demands. If we take this for granted, the contention would be that while it was right to expend money on existing generating stations, in spite of the fact that the plant bought and installed would have to be purchased at the high cost now ruling, yet it was wrong on account of the high cost to spend money on a large generating station or transmission lines under the proposals of the Elcetric Power Supply Report. Surely such a contention is not logical, and savours rather of bias than sound argument. It might be argued that it will be cheaper to reconstruct existing stations with plant of the largest capacity they are capable of holding. It is quite certain, however, that such a proceeding would only be a temporary expedient, and that ultimately a much more extended view would have to be taken, with the result that, in the long run, the total capital expenditure would be greater.

Many interesting features are being tried with a view to improving the efficiency of the generating station. Improved efficiency may be expected from the use of larger generating units working under high vacuum, higher steam pressure, and heating the condensate by means of steam abstracted from the turbine. A fourth source of possible economy may be found by re-heating the steam at different stages in its passage through the turbine. This involves considerable complication and extra expense, and it has yet to be proved whether the saving in economy obtained will be sufficient to offset the extra cost and the complication involved. In recent years the tendency has been to gradually raise the total temperature of the steam as experience has been gained with materials most suitable to withstand the higher temperature. To-day temperatures up to 700 deg. F. are considered quite satisfactory. This total temperature may be attained by using steam at moderate pressure, and a high degree of super-heat, or by increasing the pressure with a corresponding reduction of super-heat. It is on these later lines that the most modern developments are taking place, and those upon which it is expected that economies can be secured.

At the other end of the scale there would not appear to be much advantage to be gained by carrying the vacuum to a higher degree than about 29 inches, which has been attained in a number of instances. A number of turbines are being installed at the present time, in which steam is tapped from the turbine and discharged into feed heaters through which the condensate from the condenser is passed. By utilising in conjunction the heat from the steam used for auxiliaries, the feed water can be heated to a very considerable temperature, but it must not be overlooked that to carry the feed temperature beyond a certain figure would diminish the value of the economiser. In the event of this system being adopted it will be necessary to utilise the flue gases to heat the air before it enters the boiler furnace. This involves a bulky and costly apparatus, and a considerable complication in ducts to convey the hot air to the boiler furnace, but on the other hand, the expense is relieved to an extent by the absence of the necessity for the economiser.

At the higher pressures it would be an advantage if the economiser could be done away with as cast-iron becomes uncertain, and cast steel is very expensive. Wrought-steel tubes would be quite satisfactory so far as the pressure was concerned, but there would be a fear that corrosion and wastage of tubes would be excessive. To meet this difficulty a scheme has been propounded whereby pressure on the economiser is kept low by using two pumps in series, or preferably by using a multiple rotary pump. The connections to and from the economiser are placed between any two stages of pump, depending upon the pressure which it is determined that the economiser shall work at, the remaining stages being sufficient to overcome the pressure in the boiler. A system of this sort, while enabling the pressure on the economiser to be kept within the safe limits of the cast-iron tubes, adds very materially to the cost and complication of the feed pipes.

One of the troubles met with in the design of large turbines working under a high vacuum lies in the difficulty of getting sufficient area in the blades at the low-pressure end, to deal with the great volume of steam, while at the same time keeping within the margin of safety of the material composing the wheel. One way of meeting the difficulty is to use special blading on one or more of the low-pressure wheels. The special blades are made in such a way that the outer portion is of the usual requisite form, but the inner portion is almost straight, and merely forms a passage for the steam to pass to the next wheel. The last wheel is fitted with blades of the usual requisite size and form. By adopting this method a very large increase in area is provided without increasing the diameter of the wheels; it avoids the necessity for external pipes or passages in the casing; it is a very convenient and simple way of meeting the difficulty, and has much to recommend it. Several machines fitted with this type of blading are in operation, and the results seem to be quite satisfactory.

The tendency of recent years has been towards the use of higher speeds for generating plant. There will very soon be running in this country a 12,500-KW. set with 25 per cent. overload capacity for two hours running at 3,000 R.P.M., and it is likely that still larger machines running at this speed may be made in the future. The use of higher speed with larger machines brings with it difficult problems in connection with the alternator design. As the diameter of the rotor has to be kept as small as possible to keep the stresses within safe limits, the machines have to be made longer, and, therefore, additional precautions have to be taken with regard to ventilation. So far as the rotor is concerned, attempts have been made to utilise a system of water cooling by passing water through tubes inserted in the rotor forging. The results, while quite satisfactory as regards working and freedom from breakdown, have not shown the cooling effect that was anticipated, and it was thought in the particular design referred to that the extra trouble and complication involved in fitting the arrangements was not justified owing to the limited cooling effect attained.

In another design which is the same in general principle, but differs in the application, the results may be different, but it is too early to say whether better results will be attained than in the former case.

The latest method of filtering and cooling the air, which promises to show good results, is a closed system, the air being forced by means of a fan through the alternator and then through a cooler through which water is passed. On its exit from the cooler the air is ready to be passed again through the alternator. The advantage is that the air is always clean, as the same air is circulating over and over again. If this system is used where cooling towers are in operation, the water used for the cooling operation can be passed on to the cooling towers for make up.

High costs and the scarcity of domestic labour call for adaptation of apparatus which will save time and lessen labour in the home. There are at the present time many pieces of apparatus which effect great saving in household duties, such as electric washers, vacuum cleaners, electric irons, grillers, kettles, &c., all of which have been amply proved to be quite satisfactory as regards reliability and cost of manipulation. Heating and cooking apparatus have now taken their place as active competitors with other types of apparatus for effecting these services. With regard to cost of manipulation, it cannot yet be claimed that the use of electrical apparatus of this nature is cheaper than some other forms. The great drawback to its more general use is the initial cost of the apparatus, and the reluctance people have in departing from old customs. In spite of these drawbacks, apparatus of this description is a sound investment when one takes into consideration the time and labour saved, and its cleanliness and convenience. Consequently the outlook for this class of business both from the manufacturing and supply points of view is most encouraging. The public are appreciating more and more the advantages to be derived from the use of this apparatus, and as the demand grows, and the standardisation of apparatus is more complete, the initial cost will in time be materially reduced. When the areas are developed under the proposal before the country, the development of electrical apparatus in our homes will be very great indeed. As the diversity factor of this apparatus is very high it will be eagerly welcomed by the supply authorities.

Under the new proposal of Joint Electricity Authorities or District Boards, the question of distribution and transmission of electrical energy assumes a position of importance greater than that under the older system of divided control. The higher pressure to be used, the larger areas covered, and the larger power in the form of generating plant connected to the system brings into prominence the necessity for more powerful switchgear and automatic control to isolate quickly any faulty section. I would recommend our supply engineers to study carefully the various systems at present in operation, or suggested, and would point out that the addition of this apparatus with extra pilot cables, or split conductors, adds very much to the cost of the mains system. If they could devise some system which would reduce this cost it would be a great advantage.

In connection with the distribution of low-pressure current there is a problem of considerable moment affecting those undertakings which have developed their distribution on the D.C. system. With the largely increasing demand for electric cookers and radiators in the residential areas, increasing difficulty is being experienced in dealing with the applications on account of pressure drop. One solution of the problem would be to substitute A.C., but the great drawback is the cost on account of the fact that in most cases the L.P. mains laid are not the most suitable to work with an A.C. In this connection considerable advance has been made in the design and application of mercury rectifiers. There are drawbacks to this apparatus, the chief of which is that the appliance is not automatic throughout its entire range. Below a certain load the arc is not maintained, but above that point, complete automatic working is attained. Experiments are in hand with a view to making the apparatus automatic throughout its full range from no load to full load. If this can be accomplished, and those engaged on the investigations are

very sanguine of the result, such an apparatus would be of immense assistance in dealing with the outlying districts referred to. By installing sub-stations fitted with this plant on suitable sites, the existing network would be enabled to work at a very much higher current density than formerly.

The war has altered very materially the relation of the various items of cost of production to one another as compared with a pre-war basis. The cost of coal delivered into the bunkers has increased to from three to four times what it was before the war.

Wages have increased about 150 per cent., and in face of the increase of cost that undertakers have had to meet, it has been necessary to increase the charges for electrical energy in some cases up to 120 per cent. In spite of this electricity is relatively much cheaper than other commodities.

We have witnessed, owing to the war, a complete upheaval of the order of things, costs of all commodities have advanced to an unprecedented extent, and it is not to be wondered at that a very disturbing effect has been created. We may take it as a very hopeful sign that all nations are anxious to resume trade relations with one another as rapidly as possible. It is through these trade relations that the new order of things will be evolved, and in this process of evolution, electricity in its many applications will play no mean part. It is to be hoped that the nation as a whole will appreciate that what is wanted now, is a period of rest from industrial disturbances, so that commodities and prices can settle down and be adjusted to that new balance over the pre-war basis, and in order that manufacturers can quote fixed prices without fear. The adjustment is difficult, but there are ample signs that the economic laws which have been upset by Government rules and regulations are beginning to assume control again. We must exercise a little more patience, a little more of that bull-dog determination to see the job through, when, I believe, we shall see the adjustment come about much quicker than many anticipate.

THE MOTOR EXHIBITION.

With a lapse of only 12 days since the close of the Commercial Vehicle Show, during the run of which some 80,000 visitors paid for admission, the 14th International Motor Exhibition organised by the Society of Motor Manufacturers and Traders, Ltd., in connection with the Royal Automobile Club, was opened on the 4th inst., and will remain open until to-morrow. The holding of the show concurrently at Olympia, W., and the White City, Shepherd's Bush, is an arrangement due to the great demand for exhibit space, and to the necessity for providing greater comfort and convenience for visitors. It should be distinctly borne in mind that each section of the show is equally attractive, and contains fine examples of both cars and accessories; both sections must be visited to gain a proper perception of the exhibits as a whole.

The international character of the exhibition is revealed by the fact that Great Britain, France, Italy, America, Holland, and Belgium, to mention a few countries, are well represented, and the importance of the exhibition from the points of view of both quality and number of exhibits is enhanced by France's decision not to hold the usual Paris *Salon* this year. Last year the total number of exhibitors was 353; the number this year is 525, of which 266 are showing at Olympia and the remainder at the White City. There are some 156 exhibitors in the motor-car section, the majority of whom are showing several cars each, and 84 different makes of cars are shown; 51 in the carriage-work section; 41 in the tire and wheel section; and over 240 in the accessories and component parts-section.

It is not our intention to describe the many new devices, novelties, and improvements in design and construction that have been introduced since last year's exhibition, as they are not of an electrical nature. It will suffice to record that the number of electrically-driven vehicles on view has increased to four, two being of the same make, and all located at the White City, as compared with the single excellent vehicle that was shown last year at Olympia, but which is absent this year. Of the accessories exhibited a large number are, of necessity, electrical devices, since it now seems to be general practice to light cars electrically even in the smaller models. It might also be said that nearly all large, and the majority of medium size cars, now include electric self-starters in their equipment, while with regard to ignition systems, although the magneto still seems to hold its own, combined lighting, engine-starting, and ignition systems, or coil ignition, are coming into more and more frequent use.

Approximately 340 cars exhibited are fitted with British-made electric lighting and starting sets. Of this total, it is claimed that C.A.V. sets are fitted to 40 per cent.; or 45 per cent. more than the nearest British competitor.

The three types of electric vehicle exhibited have already been noticed in our columns; it will not, therefore, be necessary to describe them in detail. The "Milburn" car which should prove useful for town use or on short runs, is to be seen on the stand of Messrs. Joseph A. Mackle, Ltd.; the model shown is a three- or five-seater *coupé*, half the battery of accumulators being carried behind and half in front. The clearance above the ground seems to be rather large, but seating capacity is roomy, and the ease with which the car can be controlled should be a great point in its favour.

An electrically-driven invalid's carriage, or bath chair, is to be seen on the stand of Messrs. Carters (J. & A. Carter), Ltd., the dominating feature of which is its ease of control; the motto that it "goes by itself" is no great exaggeration, and incidentally under the new licensing regulations the carriage is subject only to the nominal registration fee of 5s. per annum. The driving energy, derived from a storage battery of accumulators placed under the well-padded seat, is supplied to a motor placed above the dual front wheels, which are fitted with diminutive pneumatic tires. The controller merely consists of a lever to be worked backwards or forwards according to the speed required, giving four speeds forward and reverse, the top speed reaching five miles per hour. The single control lever also operates the reverse switch, and in addition, when pulled right back, applies the wheel brakes. A 20-mile radius is claimed to be given on a single full charge of the battery, and the carriage will climb any reasonable gradient. The standard model is built with a miniature Victoria body comfortably upholstered, the foot board being low to the ground for easy access. The carriage is supplied complete with motor, battery, resistance, controller, fuse, main switch, voltmeter and switch, charging board and resistance lamps, but a hood and apron, front and rear electric lamps, and an auxiliary brake, which is generally recommended, may be fitted if desired.

A car which is exciting much attention is the "Crown-Magnetic" which has recently made its appearance in this country, coming from the U.S.A. where it aroused keen interest. Two complete cars, a 37-h.p. six-cylinder, and an 18-h.p. four-cylinder model, one of which we, understand, has been purchased by His Grace the Duke of Westminster, are exhibited by the Owen Magnetic Transmission Syndicate, Ltd. They have no gear boxes and no clutches; are fitted with Zenith carburetters, Berlin magneto ignition, and combined electric lighting and engine-starting sets, and have an 11-ft. 10-in. wheel-base, 5-ft. track, and a 24-ft. turning radius. It is claimed that the speed can be regulated to a degree hitherto unattainable, and the

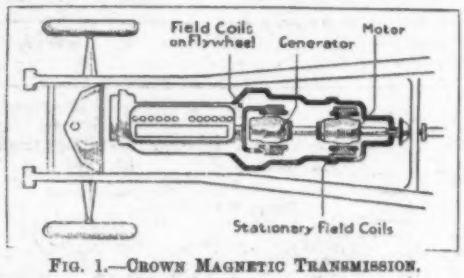


Fig. 1.—Crown Magnetic Transmission.

engine and magnetic transmission, which is the feature of the car, are combined in a complete unit, fig. 1, which operates in perfect harmony without vibration.

The engine cylinders have a 4-in. (102 mm.) bore; 5·5-in. (140 mm.) stroke; 414 cb. in. piston displacement; and 38 h.p. (R.A.C.) rating. The cylinders are cast in two blocks of three each, the overhead valves being carried on a single detachable head which fits to both sections. The valves are operated by rocker arms and push-rods entirely enclosed by cover-plates. A pump, positively driven by spiral gears from the cam-shaft, supplies oil under a 25 lb. pressure for lubrication and a centrifugal pump, positively driven from the same shaft as the magneto, takes care of the water-cooling system. The steering gear is of the worm and worm-wheel type; all control levers are stationary, and do not turn with the steering wheel. The 12-cell lighting and starting Willard battery is carried in a pressed-steel cradle with a metal cover, is accessible for flushing and readily removable without disturbing adjacent parts. The lighting equipment consists of two headlights and two dimmer lights, carried in the front lamp equipment, and a tail light and instrument-board light. All the lamps are 24-28 volt, and are fitted with "non-glare" lenses.

Turning now to the accessories side of the exhibition, out of the total of 240 firms some 80 have on view devices of an electrical nature, which chiefly consist of such articles as lighting dynamos, engine starters, accumulators, dry batteries, magnetos, spark plugs, lamps, horns, wire and cable, switchboards, and instruments, &c.

Other apparatus shown in this section includes battery-charging boards and the B.T.H. "Tungar" charger for the same purpose. This device is being publicly exhibited for the first time in this country, and its principal feature, as shown in our description on p. 382 of our September 17th issue, is a thermionic valve. Magnetic chucks, electric drills, grinders, and other small machine tools are also to be seen, as are also moulded insulating material and tapes, brass and aluminium armoured flexible electric cable, electro-plating apparatus, electric dictographs for communication between the passengers and driver of a car, and many other devices, some of which have been improved since last exhibited. In conclusion, it was noticed at the time of our visit that a number of exhibitors were making use of "Heatrae" electric radiators for heating purposes on their stands.

Emergency Orders Revoked.—The "state of emergency," as contemplated by Clause 1 of the Coal (Emergency) Order, 1920, having ceased to exist, the Secretary of Mines gave notice that as from November 4th, the terms and provisions of the gas, coal, lighting, heating and power emergency orders ceased to have effect. It was provided that that notice should not affect or prejudice anything done or suffered, proceedings taken or liability incurred, under the orders.—*The Times.*

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Lighting Covered Lawn Tennis Courts.

The satisfactory illumination of covered lawn tennis courts has always presented a difficult problem; it is, therefore, thought that an account of an attempt which has been made to solve it will be of interest. The system under review is that recently installed in the covered courts of Queen's Club at West Kensington.

There are two courts side by side, each approximately 40 ft. wide by 120 ft. long, the height of each building from the floor to the tiebeams being about 20 ft. The floor and walls are all finished dead black, so that the white balls may be readily distinguished, and in view of the bad reflecting properties of the black surfaces, direct lighting was decided upon.

It was found impossible to hang the lamps directly overhead because balls are frequently "skied" amongst the girders. After various experiments, the choice fell upon 500-

Fig. 1.—Queen's Club Tennis Court Lighting.

watt Osram gasfilled lamps mounted in G.E.C. "Angle"-type steel reflector fittings, No. F.I.155, five of which are mounted 18 ft. high along the sides of each court. The arrangement is shown in fig. 1, and a feature of the installation is the uniformity of the illumination, the maximum value being 3.4, and the minimum 3 foot-candles.

The installation was planned by the Illuminating Engineering Department of the General Electric Co., Ltd., of 67, Queen Victoria Street, E.C. 4, in co-operation with Mr. Rose, the Queen's Club electrician. We are indebted to Mr. E. B. Noel, secretary of Queen's Club, for his permission to publish the photograph and description of the lighting arrangement.

An Electric Bench Grinder.

We have received from the Wilson-Wolf Engineering Co., Ltd., Bradford, particulars of a new design of bench

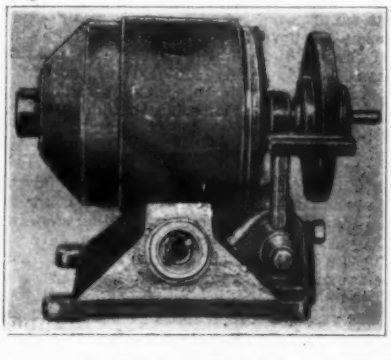


Fig. 2.—"Economic" Electric Bench Grinder.

grinder, which is known as the "Economic" (fig. 2), and is a very compact piece of apparatus, the equipment being built into the body. The motor is for D.C., and is compound wound and dustproof, developing ¾ H.P. at 3,200 R.P.M. The construction of the motor is very robust, enabling the machine to stand heavy overloads and rough treatment. The equipment includes starting switch, terminals for connection to mains, a totally enclosing cover, a 6 in. by ¾ in. wheel on a removable mounting, and a universal work rest. The grinder has rubber pads fitted under the base, and does not need bolting down. It is, therefore, portable, and it runs quietly, and is well balanced. The motor is usually wound either for 100/110 or 200/250 volts, but other ratings can be supplied.

The "Utility" Current Limiter.

A simple form of current limiter, suitable for both D.C. and A.C. circuits, has been introduced by Messrs. Electrical Utilities, Ltd., of 1-3, Shelgate Road, London, S.W. 11, who have applied for a patent. It consists of a vertical tube partly filled with mercury, in which an iron core floats; the mercury normally closes the supply circuit through a contact-piece inserted through the side of the tube, as shown in figs. 3 and 4.

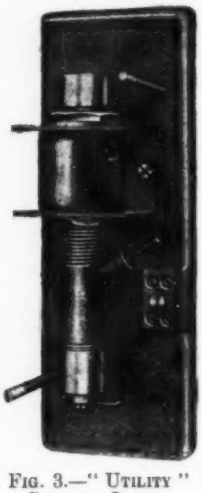


Fig. 3.—"Utility" Current Limiter without Cover.

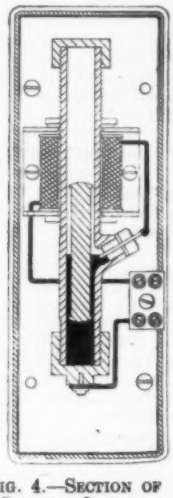


Fig. 4.—Section of Current Limiter.

The current passes through a coil round the upper portion of the tube, and if the normal current is exceeded, the core is attracted into the coil and rises, causing the level of the mercury to fall and breaking the circuit. This allows the core to fall again, and thus a pumping action is set up, causing the lamps to blink until those in excess of the proper number are switched off. The position of the tube can be adjusted by means of lock-nuts, for the purpose of calibration, over a range of 2 to 1. The instrument is enclosed in an iron case, which can be sealed. A small condenser connected across the break eliminates sparking. It is claimed that this device is simple and reliable, sensitive, ready for use without adjustment, free from deleterious sparking, and not liable to derangement. It is made for any current up to 2 amperes.

An Automobile Battery Indicator.

The *Electrical Review* of Chicago gives some details of an instrument placed on the market by the Battery Appliance Corporation, of New York. The function of this device is to give due warning when an automobile battery is fully charged or when the electrolyte level drops below a safe point. The device employs three auxiliary electrodes which project into the cells through the ordinary caps so that the bottom of each electrode is just above the top of the plates. Connections are taken from the electrodes to an instrument on the dashboard and from thence to the generator. The dashboard instrument is essentially a combination of three electromagnets which operate three indicators. Overcharging is prevented, and full charge indicated by means of a thermostat placed in the middle electrode. The action of this thermostat, it is stated, automatically alters the generator adjustment to reduce the charge when the temperature of the battery reaches 110 deg. F. The other electrodes dip into the electrolyte to make contact, and when the liquid falls in level the contact is broken, and this affects the dashboard instrument which indicates "low." With this device installed, it is claimed that the dangers due to loose, broken, or corroded connections or to high voltage resulting from overcharging are entirely eliminated.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The Thury System for Ships' Auxiliaries.

At the risk of incurring the derision of your readers, on the ground that I have "discovered" something already well known and obvious to everyone but myself, I write to inquire if any of them have heard of the application of the Thury system to ships' auxiliaries. It has occurred to me that the Thury system would show up to the best advantage in the supply of a load system mainly composed of series motors which are frequently started and stopped, as all rheostatic losses would be avoided. I imagine that the winches, &c., could be controlled merely by moving the brushes.

In Diesel-engined vessels the scheme would be specially useful. The winches and capstans, &c., and possibly the steering, could be supplied from a Thury generator, and all lighting and such power loads as run continuously for long periods, could be run from an ordinary A.C. or D.C. generator, possibly coupled to the same prime mover. The rheostatic losses would appear to be worth eliminating from the fact that vessels are, I believe, built with the steam winches piped back to a common condenser. I also read recently of a large Cunard liner, built or building, on which all the winches were driven electrically by constant-speed motors through variable pumps and hydraulic transmission.

The difficulty of insulation would only occur on very large vessels, as I imagine that about five winches would suffice for a fair-sized one, and if each were designed for 100 v. on full load, then a maximum pressure of only 500 v. would be required.

I don't know if the governing gear on the generators would work sufficiently rapidly, and I confess that I have been unable to obtain much information on the Thury system.

If there be any flaws in the project, I should be grateful to any reader who "tenderly" corrected me.

Kilowatt.

November 2nd, 1920.

Electric Welding.

In reply to Mr. H. Bevan Swift's letter of the 11th ult., *re* technical details of the welding generator mentioned in my letter of the 4th ult., to give them in a letter would take up too much space; if Mr. H. Bevan Swift is interested as a purchaser, I shall be pleased to show him, or any other interested purchaser, one of these sets at work, if he or they will communicate with me through the Editors of this journal.

Jos. W. Beswick.

Rugby, *November 2nd*, 1920.

Concerning a Review.

There is a small point in Dr. Kapp's review of my little book on "Continuous Current Machines," published in your issue of October 29th, 1920, to which I should like to draw attention. At the end of the review, Dr. Kapp says: "We cannot, however, agree with him in the statement that, having worked out the brush contact resistance loss, we need not trouble about the effect of the brush friction loss. In his case he finds the former to be 1,400 watts, the latter he does not work out, but on doing so it will be found to be something between 400 and 500 watts. . . ." Possibly Dr. Kapp was led to make this remark from a statement of mine on p. 50; but if he turns to p. 59, he will find the brush friction loss worked out from a formula based on the coefficient of friction, the specific pressure, the total brush surface, and the peripheral speed. The loss is found to be 425 watts, and has been rounded off to 500 watts.

S. P. Smith.

South Kensington.
November 2nd, 1920.

Power Factor from the Business Man's Point of View.

I have read Mr. Turnbull's third article published in your issue of the 29th ult., but it does seem to me that the discussion has been side-tracked from Mr. Turnbull's original object, which, to use his own words, was "to put into the hands of the sales department a weapon by which the man who is negotiating the price of energy could persuade the consumer to pay extra for energy used at low P.F." I have throughout in my criticisms carefully kept to the main issue, as, although the discussion on what "wattless" really is may interest the correspondents, I feel that the majority of your readers would be more interested in something less elementary and more practical.

Mr. Turnbull suggested the use of certain analogies with regard to which I have already expressed my views (perhaps rather forcibly), and I must say that my views still remain unaltered. Why I object to the banking analogy is, first, that it is quite inapplicable as a good analogy, and, secondly, that no one but a fool indulges in the transactions suggested by Mr. Turnbull, viz., to draw out from the bank £130 and immediately pay back £30; if Mr. Turnbull were to quote this to a hard-headed business man, the result, I am afraid, would be very disastrous.

I cannot but feel, after reading the articles, that Mr. Turnbull does not speak from actual experience in dealing with consumers on this subject, and in support of this view may I ask him how he would explain the following simple and everyday problem to a consumer, which is one I have had to contend with on several occasions:—

A consumer is charged on a K.V.A. demand basis, and takes, say, 1,000 K.V.A., of which 700 KW. is true power and 300 K.V.A. wattless. The object of visiting the consumer is to induce him to install a static condenser to improve the power factor from 70 per cent. to unity (I take unity as a matter of convenience only, as generally it is inadvisable to go above 95 per cent.).

According to Mr. Turnbull, without a condenser, in this example, wattless amounting to 300 K.V.A. surges to and fro between the generating plant and the consumer's plant, or, as he would put it, actual power the equivalent of 300 K.V.A. is first generated by the alternator and then returned by the motors to the alternator. Supposing for the moment we accept this theory to explain power factor to *the hard-headed business man*, and follow it up with the numerous analogies quoted by Mr. Turnbull; then how will he explain to the consumer the function of, say, a static condenser connected to the mains at the consumer's premises between the motor load and the supply company's generating plant (*i.e.*, on the supply mains)? With such a static condenser connected, to raise the power factor of the consumer's load to unity, it follows that whereas on the motor side of the condenser the total load is still 1,000 K.V.A., on the supply or generator side of the condenser the load is 700 KW. only. The surging back and forth between the *generator* and *motors* of the 300 K.V.A. wattless has suddenly ceased, due to the interposition of a static condenser. Now, if Mr. Turnbull's explanation is correct, how is he going to explain to the consumer the dispersal of the 300 K.V.A. wattless which, in his analogies and elsewhere, he deems the equivalent of energy? It is certainly impossible to claim that the condenser disperses this in heat, as the temperature rise of a static condenser is about 20 per cent. only, the rise being due to hysteresis losses only, and the static condenser certainly does not rotate.

I think Mr. Turnbull would be very hard put to follow up his arguments, analogies, and deductions referred to in his articles to explain this problem, as it must be very obvious that the "wattless" energy which he presumes to surge to and fro between the alternator and the generator can no longer exist, and, further, it is evident that the generator is quite unaffected by the 300 K.V.A. of wattless on the motors, and calmly continues to generate 700 KW. only of true energy.

If Mr. Turnbull will draw a small vector diagram representing the conditions referred to in this example, he will see that the wattless component of the load which lags 90 degrees behind the E.M.F. is exactly neutralised by the wattless leading component created by the static condenser, which is equal in value, but which leads the E.M.F. by 90 degrees; therefore these two components being equal and opposed neutralise one another. As I mentioned in my first criticism, I think Mr. Turnbull is hopelessly confused between power and apparent power; one requires steam or equivalent, the other does not.

My criticisms to date have been, I am afraid, severe, and almost wholly destructive, but to remedy this I will try shortly to write a brief article embodying constructive criticism and giving my views on the subject generally, which I hope you will consider may be of some practical value to your readers.

E. W. Dorey.

Enfield.
November 8th, 1920.

[Subject to Mr. Turnbull's reply, this correspondence must now close.—Eds. Elec. Rev.]

Electricity Supply Without Statutory Powers.

I am the engineer to the ——— Grammar School, and we wish to supply electricity for lighting, &c., to the town in which we are situated. No other electric supply exists in the district; the only other source of light for public use is that of the local gas company, which *does* not contemplate supplying electricity. Are we legally entitled to supply any customers who may ask for such supply?

J. W. S.

November 6th, 1920.

[Yes. Provided that no person, authority or company has obtained statutory powers to supply electricity in your district, you are entitled to supply it to anyone who wants it. You need not obtain the permission of the local authority unless you wish to use underground cables, for which purpose leave to break up the road surface is necessary. If you use overhead conductors, you will have to obtain wayleaves from landowners and tenants whose land you cross, but the local authority has no voice in the matter unless it happens to own the "fee simple" of a roadway crossed by your cables (rarely the case).

The Electricity (Supply) Act, 1919, has modified the position, in that if you intend to install additional generating plant you must now obtain the consent of the Electricity Commissioners to your scheme, and must comply with their requirements, which will not be onerous. You must also comply with the regulations of the Ministry of Transport (formerly of the Board of Trade) if you use overhead wires, and with those of the Postmaster-General.—Eds. Elec. Rev.]

Electrically Hardened Taps.

We have read with great interest the note in your last issue giving the results of some life tests on taps made in America and heated respectively in a gas and an electric furnace.

We note that the electrically heated taps show an increase of life of from 25 to 50 per cent. This would be very largely due to the reduction of decarbonisation, which is most easily effected in an electric furnace.

We note that the electric furnace was fitted with a pyrometer and recorder for operation on the "Hump" method. This would be of some assistance, but inasmuch as the "Hump" method only indicates the decalescence of the steel, and fails to indicate the completion of the transformation, which occurs at a temperature 15 to 30 degrees higher, it cannot be considered as more than a warning as to when the steel is approaching the completion of its change.

The complete change is shown by the steel becoming *entirely* non-magnetic, and had an efficient and sensitive magnetic indicator been fitted, we should have been surprised indeed if *more uniform* and a still greater average life had not been obtained with electric heating. It is surprising how few people realise that the decalescence transformation and the magnetic change transformation are separate and distinct for *all* steels.

Automatic and Electric Furnaces, Ltd.
E. P. Barfield,
Managing Director.

London, *November 8th*, 1920.

Cost of Living in India.

In reply to the letter in your issue of November 5th, by "M.I.E.E.," a man whose salary in this country is £600 yearly should double this figure in rupees monthly, if proceeding to any of the larger towns in India. For instance, the equivalent in India to £600 per annum at home would be about rupees 1,200 per mensem, unless quarters were provided, in which case the salary should be at least rupees 1,000 per mensem.

In the case of a senior position, the wife's passage should be paid, and allowances made for children's passage, by his employers.

It is not usual to allow expenses for outfit, but one month's salary is usually paid in advance, before sailing.

A man should have no qualms about taking his wife to Bombay with him, for he could live quite as cheaply in a boarding house or hotel as he could do were he keeping an establishment himself.

Agreements vary a good deal, and questions of illness are invariably covered in the clauses.

The question of clubs, &c., need not be considered until one arrives in the country and makes friends.

Each case needs considering individually, for conditions in different parts of India vary greatly.

I should be pleased to advise your correspondent if you would put him into communication with me.

Engineer.

November 8th, 1920.

LEGAL.

Electrician's Compensation Claim.

Sheriff MacDiarmid, Airdrie, on Saturday issued an important decision relating to an apprentice electrician's compensation claim.

Pursuer, employed with the Baton Colliery Co., Ltd., was putting the earthing wire round the gate-end box, when he noticed dirt in the box. He was attempting to remove the dirt when current was switched on, and his hands were severely burned by contact with the live wire.

The Sheriff held that in attempting to remove the dirt pursuer was obviously taking a very great risk, more especially as he had no control over the current at the time, and knew that the time during which it would be off was not a fixed but a variable time, and that the taking off and putting on thereof might be practically instantaneous. He found that the accident did not arise out of the employment, and dismissed the claim.

G.P.O. *v.* A. H. Hastie.

At the City of London Court, on October 28th, Assistant Judge Jackson heard a case in which the Postmaster-General claimed £2 4s. expenses from Arthur Hepburn Hastie, for removing a telephone from a house in Adelphi Terrace to another in Ennismore Gardens.

It appeared that Mr. Hastie, on changing his residence, gave orders for the removal of an instrument and undertook to pay £2 14s., the standard charge for such removal. The Postmaster-General refused to comply with this order, and instead put in a new installation, and claimed that he was entitled to make a charge of £4 for a new installation, although only £2 14s. was actually claimed. Mr. Hastie denied this. A witness from the General Post Office said that although only £2 14s. was claimed, it had been the invariable practice since 1915 to make an applicant for a telephone pay £4 before he was allowed to have a telephone at all, but he could not say whether there was any authority for this now permanent charge.

Assistant Judge Jackson held that the Postmaster-General had failed to carry out Mr. Hastie's orders, and dismissed the action, with costs on the higher scale on the ground that the matter was one of public interest.—*The Times.*

BUSINESS NOTES.

Bankruptcy Proceedings.—An application for discharge was made to Mr. Registrar Hope at the London Bankruptcy Court on November 3rd by E. D. Hawker and A. S. Finch (British Accessories Co.), late of 119, Pentonville Road, N. The Registrar suspended the discharge of the debtor Hawker for two years and a half, and the debtor Finch for two years on the grounds contained in the Official Receiver's report.

Henry Turner, electrician, 31, St. Paul's Road, Southsea, Hants.—The public examination of this debtor was held on November 1st, at the Court House, St. Thomas's Street, Portsmouth. According to his statement of affairs the liabilities amount to £94. Debtor commenced business in April, 1920, with £26 received as gratuity on discharge from the army. His disability pension of 15s. a week went into the business, and also £10 received from the Ministry of Munitions for an electrical invention. He attributes his position to losses on contracts in consequence of the increase in the cost of materials between the time of the acceptance of tenders and the completion of the work. The examination was closed.

T. McClelland De Bingham, engineer, 3, Longridge Road, Earl's Court, S.W.—This debtor came up for public examination on November 5th at the London Bankruptcy Court before Mr. Registrar Hope. The liabilities were returned at £1,529 and assets, consisting of systems of wireless telegraphy and of locating submarines, value not stated. Questioned by Mr. W. P. Bowyer, Official Receiver, the debtor stated that he had failed on two previous occasions, viz., in July, 1894, and November, 1906, respectively, and he had not applied for a discharge from either set of proceedings. From the date of his second failure until the outbreak of war he had been engaged in experimenting and perfecting his own systems of wireless telegraphy. Witness carried on his operations under the style of the "De Bingham Wireless Telegraph Co.," with the aid of moneys obtained by him, amounting in all to upwards of £15,000, from persons to whom he gave undertakings either to transfer, or cause to be allotted to them, shares in a company or companies proposed to be formed to acquire his inventions. No company, however, was ever formed by him, nor had any part of the before-mentioned contributions been returned. In 1918 he adopted the style of the "De Bingham Submarine Syndicate," and for its purpose he obtained sums amounting to about £1,245 from several persons (all but one being ladies). At the rising of the Court the hearing was adjourned for a fortnight.

W. H. S. Ward, electrical engineer, 56, High Street, Acton, adjudication order November 3rd.

H. J. Monson, radiographer, 26, Manchester Street, W.—Receiving order made November 3rd on creditors' petition. First meeting, November 18th. Public examination, January 21st, 1921, both at Carey Street, W.C.

J. C. Thomson, electrician, lately electrical engineer and contractor, Station Street, Mansfield, Notts.—First meeting, November 17th at Official Receiver's Office, Nottingham. Public examination, December 2nd, at the Court House, Nottingham.

Company Liquidations.—Riglite Manufacturing Co., Ltd., electrical engineers, &c., 18, Cowleaze Road, Kingston-on-Thames. The creditors interested herein were called together recently at the offices of Messrs. J. F. Legg, 11, Queen Victoria Street, E.C. The shareholders of the company had previously passed the usual resolution in favour of voluntary liquidation, and appointed Mr. Legg as the liquidator. The statement of affairs presented showed liabilities amounting to £3,296, of which £760 was due to trade creditors and £1,033 was owing to the directors of the company for unpaid

salaries and interest accrued. In addition, there were three unsecured cash creditors whose claims aggregated £502, while debentures to the extent of £1,000 had been created. There were also fully secured creditors for £41, the securities held being valued at £67. The assets were estimated to realise £1,532, from which had to be deducted £207, preferential claims, leaving net assets of £1,325. The statement also showed that there was a liability on the part of the company of £2,000 in respect of an electric light invention. Against that liability it was stated that there was £2,000 due for the issue of 2,000 shares in the company. The latter was registered in March of the present year with a nominal capital of £5,000, divided into shares of the face value of £1 each. In all 4,700 shares had been issued, and practically all were allotted for cash. The present position had been brought about through the falling off in trade, and it was pointed out that since its inception the company had paid no fees or remuneration to the directors. Mr. Legg further stated that in addition to being the liquidator of the company he had also been appointed to act as receiver for the debenture holders. A suggestion was made that an independent liquidator should be appointed, but this was not agreed to, and after a short discussion it was decided to confirm the voluntary liquidation of the company with Mr. Legg as liquidator.

Eastern Engineering & Supply Co., Ltd.—Winding up voluntarily. Liquidator Mr. A. Hartley, 70a, Basinghall Street, E.C., to whom particulars of claims should be sent by November 22nd. Meeting of creditors November 15th, at 9, Ironmonger Lane, E.C.

British Electrical Accessories, Ltd.—Meeting of members called for December 15th at High Street, Skipton, to hear an account of the winding-up from the liquidator, Mr. W. A. Judge.

Electro-Chemical Developments, Ltd.—Winding up voluntarily. Liquidator: Mr. E. A. Ashcroft, 65, London Wall, E.C., who is authorised to carry into effect the agreements made with the Magnesium Metal Co., Ltd., and the Magnesium Chloride Co., Ltd.

Dissolutions of Partnership.—W. E. Weekes & Co., electrical and telephone engineers.—Messrs. W. E. Weekes and C. H. Clarke have dissolved partnership. Mr. Clarke will attend to debts and continue the business.

Hamson & Tayler, mechanical and electrical engineers and motor-car proprietors, Hanham Road, Kingswood, Bristol.—Mr. H. P. Hamson and Mr. S. A. Tayler have dissolved partnership. Mr. S. A. Tayler will attend to debts and continue the business in his own name.

Trade Announcements.—"Z" Electric Lamp and Supplies Co., Ltd., Standen Road, Southfields, announces that the company has been formed to carry on the sale of "Z" vacuum and gasfilled lamps and electrical appliances, including "Electrolux" suction cleaners, on similar lines to that hitherto carried on by the "Z" Electric Lamp Manufacturing Co., Ltd. (in liquidation), and by arrangement with the liquidator it will be trading from November 1st from the factory at Southfields until the London offices and showrooms, 73, Newman Street, W. 1, are ready for occupation. Arrangements have been made with the liquidator for the company to act as sole selling agents for the sale of the old company's finished lamps and accessories, and the sale of these stocks will be immediately taken in hand.

The Armature Repairing and Supply Co., Ltd, electrical and mechanical engineers, announces that larger premises have been secured, and that the new address will be Hafod Electrical Works, Pipe House Wharf, Swansea, to which all future work and correspondence should be sent. The telephone number and telegraphic address will remain the same.

Messrs. Lawrence Reynolds & Co., Colonial Chambers, 13, Crutched Friars, E.C. 3, inform us that they have secured the sole selling rights for fire bars and mica elements from Messrs. The Automatic and Electric Furnaces, Ltd., Gray's Inn Road, W.C.

Catalogues and Lists.—Messrs. Jones & Pordes, 8, Crawford Passage, London, E.C. 1.—Particulars of the "Elba" portable bell set for private houses, offices, &c.

The Record Engineering Co., Ltd., Tutbury, Burton-on-Trent.—Leaflet giving test records of the "Silent Record" petrol, paraffin, or gas engine.

Messrs. Electrical Conduits, Ltd., Birch Street, Walsall.—Two illustrated and priced lists (October 10th, 1920), dealing with lighting switches, lampholders, plug sockets, watertight fittings, and switches, &c., also fuseboards, wire, cable, stocks and dies, &c.

Messrs Electric Fires, Ltd., King Street, Norwich.—Illustrated and priced catalogue, dealing with electric radiators of various sizes and types.

Messrs. Pope's Electric Lamp Co., Ltd., Elasta House, 5, Arthur Street, New Oxford Street, W.C. 2.—A folder dealing with "Elasta" drawn-wire electric lamps. Priced.

The Parsons Motor Co., Ltd., Town Quay Works, Southampton.—A well-illustrated descriptive list (63 pp.) of marine and stationary oil engines. Each type is fully priced and all accessories are listed.

The General Electric Co., Ltd., 67, Queen Victoria Street, E.C. 4.—Illustrated and priced booklet, No. H 2,380, 32 pp., which opens with some notes on electric cooking in general, and on "Magnet" domestic appliances in particular. Many of the heating and cooking devices illustrated will make seasonable gifts, and all appeal from the point of view of general usefulness. Also leaflet No. H 2,379, illustrated and priced, dealing with a selection of hot-plates and grids especially suitable for hotels and restaurants.

Messrs. H. W. Sullivan, Winchester House, E.C. 2.—Illustrated and priced booklet, List W 2, 47 pp., dealing with all manner of instruments and component parts of apparatus for the reception of wireless telegraphy.

The Arora Co., Loughborough, Leicestershire.—Illustrated and priced booklet, 16 pp., dealing with heating and cooking apparatus, and including new types of cooking oven and radiators. The new prices carry a trade discount of 25 per cent., as recommended by the B.E.A.M.A. During the last six months the company has completed a new up-to-date factory.

Messrs. British Insulated & Helsby Cables, Ltd., Prescot, Lancashire.—Leaflet comprising a list of the firm's manufactures, and giving the names and addresses of its agents and branch offices throughout the world.

The Stanton Ironworks Co., Ltd., near Nottingham.—Monthly stock list of cast-iron pipes.

The Edison Swan Electric Co., Ltd., Ponders End, Middlesex.—Illustrated booklet, 15 pp., dealing with "Ediswan-Acme" accumulators suitable for motor-car lighting as well as ordinary purposes.

Book Notices.—"The Mining Electrical Engineer." Vol. I, No. 1. October, 1920. (36 pp.) 1s. net monthly.—This is the first appearance of the *Journal* of the Association of Mining Electrical Engineers, which, as many of our readers will remember, was formed as the outcome of correspondence in the columns of the Electrical Review about 11 years ago. Under the editorial direction of Mr. E. Dinsdale Phillips, the journal has made an excellent *début*, containing as it does a number of practical articles dealing with the important part played by electricity in modern mining. These articles include "Small Pipe-Ventilated Motors," by Mr. W. de M. Landon; "A New Electrically-Driven Winding Equipment at Kilton Collieries" (illustrated); and "Electric Signalling in Collieries" (illustrated). Several pages are devoted to a record of the proceedings of the various branches of the Association, and a section, "Manufacturers' Specialities," illustrates switchgear, haulage gear, motors, &c.

Technical Paper No. 168 of the Bureau of Standards, "Colour and Spectral Composition of Certain High-Intensity Searchlight Arcs." Quantitative data are given on the colour and spectral distribution of energy of some modern searchlight arcs, together with spectroscopic analyses of the carbons, and methods of measurement are described. Anyone interested can obtain a copy by addressing a request to the Bureau of Standards, Department of Commerce, Washington, U.S.A.

"Slide Rules, and how to use Them." By Thos. Jackson. Pp. 30; figs. 16. London: Chapman & Hall, Ltd. Price 1s. 6d. net.—A useful little publication dealing with the general principles of, and the manner of using, the "Gravet" rule, four types of log-log, and six different special slide-rules, and the "Boucher" watch form of calculator.

"Electrolytic Medication (Ionisation)." Rochester, N.Y.: Ritter Dental Manufacturing Co. (Inc.). Pp. 71; figs. 8.—An interesting little treatise presented to the dental profession not as a text-book, but as a concise explanation of the theory, technique, and clinical applications of electrolytic medication, electrosterilisation, ionic medication, or ionisation as the subject is variously termed, a therapeutic agent which is proving very successful in dentistry and medicine. It is a comparatively new method of treatment in which drugs are introduced into the subcutaneous parts of the body by means of an electric current.

Messrs. Benn Brothers, Ltd., announce that with the New Year they will publish "The Transport World: The Journal of the Road Carrying Industry," a new weekly for all interested in motor road transport. A Freight Exchange Section will provide each week an immediate index of freight ready for delivery, and offers of transport in vehicles running to and from all parts of the country. The regular use of these columns by producers and carriers should remove the chief hindrance to trade expansion by utilising the enormous "Return Empty" mileage which is now lost.

"Science Abstracts," (A and B). Vol. XXIII. Part 9. September 30th, 1920. London: E. & F. N. Spon, Ltd. Price 2s. 6d. each.

"Industrial Gases." Vol. I, No. 5 (34 pp.). Price 1s., post free.—The September issue of this journal contains illustrated articles on "The Effect of Aluminium in Cast-iron Welding Rods," "Oxygen and Nitrogen Production in Germany," &c.

"*Metropolitan-Vickers Gazette*," No. 91, contains a detailed description of a large blast-furnace charger, the continuation of the articles on feed heating and porcelain, and a note on current-limiting reactors.

Electrical Supplies in South Africa.—The *South Africa Mining and Engineering Journal* for October 16th says electrical materials still continue to arrive, and full stocks are now held in all lines. Although the tendency of prices at Home is to rise, no alterations in values have taken place locally. Stocks from the Continent come much lower than from Britain or America, notwithstanding the increased cost of raw materials borne by Continental manufacturers, as their labour troubles are not affecting them to anything like the same extent as they are making themselves felt in Britain and America. As an instance of this, English shades are ruling at from 4s. 6d. to 5s. 6d., as against 2s. 9d. for the Continental article. The latter may not be able to compete as regards finish with the British article, but contractors who have to cut things fine have no alternative but to take the cheaper article, and the public is not too altruistic when its pocket is affected. Business continues fairly good in town and along the reef.

Lead Report.—Messrs. James Forster & Co., in their lead market report, dated November 6th, say: Closing prices last week were £36 5s. for October to £35 15s. for January, against £35 15s. for November to £35 2s. 6d. for February at yesterday's close. The week has been again marked by scarcity of prompt lead, but forward positions have shown weakness through "bear" selling. Ten shillings per ton for prompt over November shipment has been freely paid, and at the close yesterday there were buyers for October shipment at £36 5s. with no sellers. (The 8th is the last day for declaration against the previous month's contracts.) The selling on the Metal Exchange has been chiefly for next year, the lowest prices accepted being £34 17s. 6d. for March, £35 for February, and £35 5s. for January.

Messrs. G. Cawson & Co. say: Stocks were drawn upon last month by nearly 4,000 tons, and the quantity available is now much reduced, the bulk of which is held off the market. It is just possible that the shortage in November may be quite as severe as in October. Forward lead has been pressed for sale speculatively, and some low prices have been accepted

Siemens-Schuckert Steel Works.—The latest scheme in Germany is the proposed establishment of a community of interests in some form or other between the Siemens & Halske Co. and the Siemens-Schuckert Co. on the one hand, and the Deutsch-Luxemburg-Gelsenkirchen Mining and Iron and Steel Works on the other, through the pooling company formed by these two companies under the title of the Rhine-Elbe-Union. The moving spirit in the matter is Herr Hugo Stinnes, who desires to secure definite and permanent markets for the production of the two companies; while the electrical firms wish to ensure the delivery of steel sheets, wire and other steel products on favourable terms without having to consult the market. After the observations made at the recent meeting of the A.E.G. concerning the attitude of the steel makers, it is scarcely surprising that the Siemens group is taking the initiative in the matter of securing independence of the maximum prices fixed by the Federation of the Steel Industry. The latter is certainly able to dictate the prices to be charged as between makers and customers, but with the formation of a community of interests between steel makers and electrical firms, the deliveries by the former to the latter would assume the form of one department of an undertaking supplying products to another in the same undertaking, and would thus escape the control of the Federation. It is understood that there is no question of the Siemens group intending to relinquish its independence. Yet at the back of this scheme and the many others now under consideration there lies the threat of nationalisation, which it is hoped to avert or at all events to render so difficult of accomplishment as not to be worth proceeding with under the rapidly changing circumstances in Germany.

International Exhibition at Lima, Peru.—Land in the business district of Lima has been set aside by the Government for the site of the International Industrial Exhibition, and a building for the Peruvian Centenary Celebration, which will be held next year. A contract has been awarded for the construction of the buildings, and work will commence immediately; it is expected that it will be completed by next May. American Government representatives at Lima have already taken tentative options on 10,000 sq. ft. of floor space.—*Reuter's Trade Service* (Lima).

Shipping, Engineering and Machinery Exhibition, 1921.—This exhibition will be held at Olympia, from September 7th to September 28th, 1921. Priority is to be given to British exhibitors, especially those showing machinery in motion, &c.

The Cost of the Coal Strike.—In the House of Commons on November 8th, in reply to Sir James Cory, Mr. Bridgeman (for the Department of Mines) stated that the loss in coal output through the coal strike was estimated at from 13,000,000 to 14,000,000 tons, and the loss in wages to the miners at £14,000,000 to £15,000,000. It would appear probable that consequent on the strike the total increase in the number of unemployed (apart from those employed at the coal mines) could not have been much less than 350,000.—*Financial Times.*

Wages in the Engineering Industry.—The negotiations on the claims of the Amalgamated Engineering Union for an increase of 6d. an hour have been proceeding smoothly with the employers. The Union has stated its case, and the employers will, it is expected, give their considered reply at a conference arranged for November 17th.—*Birmingham Post.*

Concert.—The annual concert of the Halifax Corporation Tramways and Electricity Employés' Society was held last week, at the Victoria Hall, and was a decided success. The proceeds are in aid of local charities and of the employés' benevolent fund. The Tramways Glee Party rendered good service.

Employment in Lead Processes Bill.—The Women and Young Persons (Employment in Lead Processes) Bill passed through Committee of the House of Commons on Friday last week without amendment, and was read a third time.

Minimum Wages Bill.—In the House of Commons on Monday last, Mr. Lloyd George stated that it would be impossible this session to proceed with the Minimum Wages Bill. It was the intention of the Government to proceed with it next session.

Forthcoming Exhibitions.—The following exhibitions are being organised:—

Cardiff.—January 26th—February 5th, 1921.—"Health and Home" Exhibition (see ELECTRICAL REVIEW, October 22nd).

London.—February 10th—26th, 1921.—"Efficiency" Exhibition at Olympia (ELECTRICAL REVIEW, June 25th).

London.—June 3rd—17th, 1921.—Rubber Trades, at Royal Agricultural Hall (ELECTRICAL REVIEW, April 9th).

London, Glasgow, and Birmingham.—February 21st—March 4th, 1921. — British Industries Fair (ELECTRICAL REVIEW, August 13th, September 24th, October 8th).

London.—1923.—British Empire Exhibition. (ELECTRICAL REVIEW, May 14th, June 11th, September 24th, November 5th).

London.—Jan. 5th—6th, 1921.—Physical Society's Exhibition. (ELECTRICAL REVIEW, November 5th).

London.—September 7th—28th, 1921.—Shipping, Engineering, and Machinery Exhibition, at Olympia. (ELECTRICAL REVIEW, November 12th).

London.—November 29th—December 4th.—Advertising Exhibition at the White City.

London.—Cycle and Motor-Cycle Show at Olympia, November 29th—December 4th.

Manchester.—Toy and Fancy Goods, January 3rd-14th, 1921.

Brussels.—Commercial Fair (International), April 4th-20th, 1921.

British Dominions.—1921.—Dominions Touring Exhibition (South Africa, New Zealand, Australia, and Canada).—(ELECTRICAL REVIEW, March 26th, August 6th).

Lima.—1921.—International Industrial Exhibition. (ELECTRICAL REVIEW, November 12th).

Ghent.—April 16th—June 14th, 1921.—International Exhibition of Architecture, Building, and Kindred Industries. (ELECTRICAL REVIEW, September 24th).

Peking.—1921.—International Exhibition.—(ELECTRICAL REVIEW, September 10th).

South Africa.—Chemical, Metallurgical and Mining Exhibition in Johannesburg, from Wednesday, March 9th to 16th, 1921, inclusive.

Iceland.—World's Fair, June, 1921.

The Institute of Cost and Works Accountants.—Arrangements have been made to hold the examination, in connection with this Institute, on December 6th and 7th, in London, Manchester, Birmingham, Glasgow and Sheffield. Forms of application and further particulars may be obtained from the Secretary.

Copper and Lead Prices.—MESSRS. F. SMITH & Co. report November 9th, copper (electrolytic) bars, £102, £3 increase; ditto sheets, no change; ditto wire rods, £118, £3 increase; ditto H.C. wire, ¼d., ¼d., ¼d. increase.

MESSRS. JAMES & SHAKESPEARE report November 9th, copper bars (best selected), sheet and rod, £152, £3 increase; English pig lead, £37, 5s. decrease on last week's prices.

Anti-Dumping.—The President of the Board of Trade recently stated that the Government intended to introduce legislation with a view to the prevention of dumping as early as possible. The subject of Merchandise Marks will also receive attention. It does not appear probable, however, that any effective steps will be taken before next year.

Polish Cable Company.—The *Deutsche Zeitung*, learns that a cable company, the Kabel Polski, has been formed at Bromberg, with a capital of 20 million marks. The technical direction of the concern has been placed in the hands of the former vice-director of the Deutsche Kabelwerke at Berlin. The object of the company is to render Poland independent of the German cable subvention.—*Reuter's Trade Service* (Berlin).

Foreign Samples Exhibition.—The Foreign Samples Exhibition of the Department of Overseas Trade will be opened in the Old Bailey on November 23rd by Mr. Kellaway. There are 160,000 samples of goods manufactured abroad in competition with British industries.

Swedish Import Duties on Electrical Goods.—The Swedish Electric Industries Association has addressed a petition to the Government urging an immediate increase in the Customs duties levied on imports of articles manufactured by foreign electrical industries.—*Reuter's Trade Service* (Stockholm).

Inter-works Football.—Messrs. Dick, Kerr & Co.'s team, Preston, has been drawn to play Coventry Ordnance Works in the semi-final tie for the Sir Chas. Ellis Cup—an inter-works competition in connection with the English Electric Co. Last year's winners were Dick Kerr's, who are meeting the Coventry Eleven on November 13th.

Swedish Glow Lamps.—The A.B. Skandinaviska Glodlampfabrik and the A.B. Elektraverk, of Stockholm, have made representations to the Government asking for the restoration of that measure of Customs production which existed before the war, but which has been destroyed through the depreciation of foreign currency, which facilitates foreign competition in Sweden. If the import duties are not increased in proportion to the decline in money values, the companies state that they will be compelled wholly to cease production. Substantial restrictions in working have already taken place, a number of workers have been discharged, and the remainder are working chiefly for stock.

Russian Lamp Orders.—The representative in Berlin of the Soviet Government is reported to have been authorised by the commissariat for foreign trade to purchase in Germany 1,300,000 Osram lamps, and 250,000 other types.

Trade with Guatemala.—H.M. Minister, Guatemala, states, in a recent letter to the Department of Overseas Trade, that conditions are about to be very favourable for British trade, provided that British merchants and manufacturers are alive to their opportunities. The new Government is reported to be strong, energetic and businesslike, and it is considered that a very promising future is now opening for the Republic in question. There is a great demand for English machinery and for all kinds of tools. Catalogues should be addressed to Sr. Ministro de S. M. Britanica, Ciudad de Guatemala, Republica de Guatemala.

British Industries Fair (Birmingham).—The following electrical firms had taken space up to November 2nd:—Messrs. Berry's Electric, Ltd., Edison Swan Electric Co., Ebonestos Manufacturing Co., Etna Lighting and Heating Co., Donovan & Co., Edgar A. J. Hooper, Ltd., Improved Solidite Co., Ltd., Ironclad Switchgear Manufacturing Co., Ltd., C. H. Parsons, Ltd., Premier Electric Heaters, Ltd., Sutcliffe (of Crumpsall), Ltd., Semaphore Manufacturing Co., Townshends, Ltd., J. H. Tucker & Co., Ltd., Watertight Fittings, Ltd., William Sanders & Co., Mark Webber, Ltd., Electrical Conduits, Ltd., F. & C. Osler, Ltd., Siemens Bros. and Co., Ltd., Wm. McGeoch & Co., Ltd., Simplex Conduits, Ltd.

A Trade Black-List.—The question whether a trade association can legally insert in a "stop list" the name of a firm alleged to have transgressed some regulation of the association, is the subject of an action now being heard by the Court of Appeal. It is said to be one of the most important cases that have arisen in recent years in connection with the methods of protection adopted by combinations of manufacturers.

Peaceful Penetration.—A correspondent has sent us a letter which is being circulated to power station engineers by a Swedish firm—a branch of the A.E.G.—and offers ampere-hour meters at low prices from stock in Stockholm, as well as "from our stock in Berlin, meters provided with English nameplates." Delivery within two weeks is offered.

Canadian Trade.—Canadian imports from the United Kingdom during the 12 months ended on September 30th amounted in value to $138,288,000 (about £28,800,000 at par) more than in the preceding year, while exports to the United Kingdom were $174,000,000 (£36,200,000) less.—*The Times.*

Lyons Fair.—It is reported that 900 exhibitors took part in the Lyons Autumn Fair, a smaller number than on previous occasions. Buyers also were less numerous.

Strike in Germany.—A strike of 300 electricians and draughtsmen has caused the closing of the Borsig works at Tegel, throwing 5,000 men out of work. It is said to be due to political motives, to prevent the dispatch of electrical plant worth 500,000 marks to Hungary, on the ground that that country is supporting Poland against Russia.

Electric Light Switching Examinations.—Messrs. A. P. Lundberg & Sons have sent us the report of their examiner, Mr. W. H. Bray, A.M.I.E.E., on the seventeenth examination, the results of which appear in our advertisement pages to-day. The numbers of successes and failures are about equal, the standard being maintained at a high value. One examinee has equalled a previous record by securing first place in the three grades of successive examinations. We shall refer to the subject at greater length in a later issue.

Trade with Canada.—Mr. F. W. Field, H.M. Trade Commissioner at Toronto, who has recently arrived in this country, is at present at the Department of Overseas Trade interviewing firms in London who are desirous of obtaining information as to the possibilities of extending their trade in Canada. London firms who are desirous of consulting him should communicate with the D.O.T., 35, Old Queen Street, S.W. 1. He will subsequently visit some of the leading industrial centres.

For Sale.—Messrs. E. Mitchell & Sons will sell by auction on November 29th and the following days at the Duchy of Cornwall Mines, Hingston Down, Gunnislake Cletters, and Kit Hill United, Cornwall, the whole of the mining machinery, plant, &c., including electric generators, dynamos, accumulators, &c. For full particulars, see our advertisement pages to-day.

New Magneto.—Bulletin No. 206 of the British Chamber of Commerce—Paris (Inc.) states that the Chamber has received information regarding an improved and simplified magneto, and will be pleased to place interested members in communication with the makers.

LIGHTING AND POWER NOTES.

Birmingham.—Coal Shortage.—The Electric Supply Committee issued, during the week-end, an appeal to the public to exercise the utmost economy in the use of electricity. Quantities of coal have had to be drawn from stock since the beginning of the strike, and it is necessary that these withdrawals should be replaced before the winter loads have to be met. If the coal deliveries expected were made, consumers were to be given their full supplies from Tuesday. If the coal did not arrive, the small reserve stock would be used up and the risk involved would be taken.

Bradford.—Developments.—On the occasion of a visit to the Corporation electricity works, last week, by the Bradford Textile Society, Mr. Thos. Roles, city electrical engineer, gave an address on the history, achievements, and prospects of the undertaking. The occasion was particularly interesting in that the President of the Society (Mr. Wilfrid Turner) is also chairman of the Electricity Committee; but, unfortunately, he was unable to attend. Mr. Roles bore witness to the enthusiastic support of the chairman and members of the Committee ever since Bradford had such a body, and remarked that in 1883, within a year of the Electric Lighting Act being passed, Bradford had a provisional order for municipal supply, and the works were opened in 1889. Mr. Roles mentioned that much of the original plant was still running. In recent years there had been great developments, especially in heating and cooking; there were hundreds of electric fires in use in the city, and cooking apparatus was in increasing demand; the cooking for the men at the works had been done by electricity for 10 years past. The demand for electricity for power in the textile industry had grown greatly, and already 100,000 spindles and some 4,000 looms were electrically driven. Several new sheds now being erected were to have electric power. The demand of the textile trade was equal to 8,610 kw. Of the £1,315,000 capital expended on the undertaking in its 31 years' history, £659,000 had been paid off. Developments about to be made would bring the capital expenditure up to £2,000,000; the income last year was £329,000, and it was expected to reach £400,000 this year. There were 6,429 consumers, 1,000 having been added during the past year. A new boiler house was to be built, at a cost of £300,000, to be completed in 12 months. The four water-tube marine-type boilers would have a steaming capacity equivalent to that of 35 Lancashire boilers. A new 12,000-kw. generator had just been installed, and another to be provided would bring the capacity up to 50,000 kw. The works had originally been designed for 5,000 kw. Such plant would probably meet all Bradford's demand for five or six years. Beyond that it was very doubtful whether Bradford would be allowed by the Commissioners to build a new station, and the probability was that the city would draw its further supplies from the super-station for the Aire and Calder district. Probably that super-station would be commenced during the next two years. He did not suppose one such super-station would eventually be sufficient for the area, and other stations would have to be erected from time to time. At these stations the individual generating sets would probably be of 25,000 to 30,000-kw. capacity, as compared with Bradford's present largest set of from 12,000 to 15,000 kw.

Cheriton (Kent).—Street Lighting.—The Urban District Council is to have converted from gas to electricity 27 public lamps on the cable route.

Church Stretton.—Street Lighting.—The Urban District Council has made arrangements with the Church Stretton Electric Supply Co. to light extra lamps by electricity during the three seasons 1920—1923, at a charge of £5 10s. per lamp.

Darlington.—Working Costs.—The Town Council Electricity Committee, on November 4th, recommended that the manager should be allowed a bonus of 5 per cent. on any reduction in the working costs effected below those which obtain in other municipal supply undertakings.

Price Increase.—Dealing with a recommendation that the charge for electricity should now be 4½d. per unit, this being an increase of ½d. per unit, Sir Charles Stormer said the Committee had thought it would be able to finish the year without increasing the cost, but it had been unable to do so. Before the war the charge was 3½d. There were only two places supplying electricity at less than 4½d., and they were Middlesbrough and Burnley. Middlesbrough had a pre-war contract with the Power Co. to supply electricity at 4d., a contract made when Darlington was only charging 3½d., and when that contract expired it would have to face a very large increase, for the same company was supplying Newcastle at 5½d. per unit, and it was hardly conceivable that Middlesbrough would not have to pay the same. The report was adopted.

Dublin.—Supply Restrictions.—The continued coal shortage is causing the Corporation Electricity Supply Committee a good deal of anxiety just now. Mr. L. Raul, chairman of the committee, has issued a letter in which he says that, notwithstanding the coal strike settlement, the shortage will be felt for many months. The active co-operation of electricity consumers is immediately essential in order to enable the department to avoid a stoppage. At present rates of consumption the supply will last only two weeks, if no fresh supplies are received meantime. The hours during which special economy is necessary are from 4 to 6 o'clock in the afternoon. Between these hours electricity users should adopt the following suggestions:—"Power users to take off all machines possible between the hours of 4 p.m. to 6 p.m. Lighting consumers to cut off all display lighting of every kind between these hours, and to reduce all ordinary lighting between 4 and 6 p.m. by at least 50 per cent. All radiators and other apparatus to be kept off between the hours specified."

Should the military Curfew Order, now in operation from 12 midnight to 3 a.m., be extended, as expected in some quarters, so as to operate from 10 p.m. to 3 a.m., public electric lighting will be further curtailed, all lights being extinguished at 10 p.m., under

the Corporation regulation, which provides that absolute darkness should reign during curfew, or, in other words, that no facilities should be given to the military patrolling the streets, or engaged in raids for arms, &c.

Dungiven (Co. Londonderry).—Fire.—The electric generating station erected by Mr. A. Temple, J.P., some 10 years ago, has been destroyed by fire.

Continental.—Germany.—In consequence of a sudden strike of hands at the municipal electrical stations, Berlin was on November 7th without tramcars and for the most part without artificial light. The deprivation of light was acutely felt in some hospitals, where it was found impossible to perform urgent operations. Work on the Underground Railway was endangered by the stoppage of electrical pumps, and the rising water is said to threaten houses in the neighbourhood with collapse. Most of the newspapers failed to appear. As the intervention of technical emergency volunteers always causes bad blood among the workmen, this body was not called in until the evening was well advanced, and as the fires were out and the boilers cold its activity was not of much avail. Later it was agreed by the men to keep going most of the vital services, such as those which supply the hospitals, public buildings, and street lighting. The strike concerns wages, and is caused by the precipitate rejection by one small group of the arbitration award affecting all classes of municipal workmen.

The strike on November 6th extended to the tramways, which, owing to the lack of electricity, had to cease running. According to the *Berliner Tageblatt*, the tramway workers came out in sympathy with the electrical strikers, who are also said to have approached the railwaymen with a view to inducing the latter to join them.—*Reuter's Trade Service* (Berlin).

Giffnock. — Lighting Scheme. — The Clyde Valley Electric Power Co. is to introduce electric lighting into Giffnock, an important suburb of Glasgow.

Keighley.—Loan.—The Town Council last week decided to make further application for power to borrow £30,000 for the requirements at the electricity works. A sum of £9,000 relates to excess expenditure ; £1,000 on converting plant ; £800 on a water-tube boiler ; £7,200 on boiler-house equipment ; and the remaining £21,000 is estimated expenditure, during the next two years, on new mains (£10,000), meters on hire (£3,000), services (£5,000), and sub-station equipment (£3,000).

Kirkburton. — Electricity Scheme. — The District Council, last week, agreed to support an application by Huddersfield Corporation for power to supply electricity for light and power in the Kirkburton district, subject to the Corporation paying the costs and on the assurance that the mains would be laid within 12 to 18 months after consent had been given.

Lincoln.—Extensions.—On November 4th, the Town Clerk announced the receipt of the sanction of the Electricity Commissioners to the borrowing of £11,260 for new electrical generating plant, foundations, &c., the loan to be repayable in 10 years, and £1,500 for switchgear, repayable in 20 years.

London.—Bermondsey.—At a recent meeting of the Borough Council, Alderman H. R. Trott advocated the reduction of overtime work in municipal offices. He referred to the electricity department in which the normal week consisted of 47 hours. One man received in a recent week a wage of £5 5s. 1d., and £10 18s. 4d. overtime ; two men whose wages were £5 0s. 8d. each, received £10 0s. 3d. and £8 19s. 6d. extra respectively ; four fitters' mates, whose wages were £4 8s. 4d. each, had as overtime pay £9 8s. 7d. in two cases, £9 4s. 6d. in another, and £8 3s. 11d. in the fourth case.

Lurgan.—New Station.—The Urban Council has adopted a recommendation that the new generating station in connection with the public electric lighting scheme should be placed in the gasworks yard, the manager of the gasworks, Mr. J. A. Tallintine, to be paid 2½ per cent. on the engineering work, based on the capital expenditure.

Marsden. — Expert Advice. — The Urban District Council has asked Mr. J. E. Schofield, electrical engineer, of Bradford, to fully investigate and report to the Council upon the scheme of Councillor G. H. Whiteley, for electric lighting. A further interview is to be arranged with the Electrical Distribution of Yorkshire, Ltd., relative to its proposal to include Marsden in the area for which it desires to obtain powers to supply electricity.

Mersey and West Lancashire Electricity District.—Asking that it be allowed until March 31st next to prepare and put forward an electricity scheme, the Birkenhead Corporation has written to the Electricity Commissioners objecting to the inclusion of Birkenhead in the proposed area to be called the Mersey and West Lancashire Electricity District. (See p. 106 of our July 23rd issue.)

Mitcham.— Housing Scheme.— The Urban District Council has asked the Ministry of Health to grant permission for electric light to be installed in the Western Road houses, in preference to gas. The estimate for electricity is £2,637 12s. with overhead cables, and £880 more if the cables are underground, and that for gas £2,352 16s., plus £52 10s. if coppers are heated by gas.

Nelson. — Breakdown.—A serious mishap, involving considerable damage, occurred at the electricity works last week. One of the large generators, which it was intended to replace at a later date, completely collapsed owing to the breaking of a crank-shaft. It is stated that the damage is irreparable. Owing to the timely help of the Colne and Burnley electricity departments, there was no stoppage of the tramway system, but the supply of electricity for lighting and power purposes was suspended for two hours. Arrangements have now been made for Colne and Burnley Corporations to supply electricity to Nelson Corporation for its tramway service.

Newport (Mon.).—Year's Working.—The total revenue of the electricity department for the year ended March last was £100,001, compared with £80,083 for 1918-19. Working expenses amounted to £66,491, as against £54,696 last year, leaving a gross profit of £33,510 (£25,387). Interest, sinking fund, &c., charges absorbed £24,699 (£22,318), making the final result a net profit of £8,811, more than double the previous period's figure—£3,069.

Rathmines (Dublin).—Bulk Supply.—The Lighting Committee's report states that the Dublin (Electric) Tramways Co. is unable to assist in the extension of the electrical plant. Dublin Corporation could give a small supply from the Fleet Street station, but if more were required, it would be necessary to go to the Pigeon House station, which would be very costly. The Committee's recommendation was that the engineer be asked to advise on obtaining a supply in bulk.

Price Increase.—The Urban District Council has given notice that the charge for energy for heating and domestic purposes will be increased to 4½d. per unit, as from the commencement of the March quarter, 1912.

Skipton.—Bulk Supply. — In connection with the inquiry from the District Council whether Keighley Corporation would supply Skipton with electricity, it is stated that possibly some of the industrial villages between the two towns would take a supply under such a scheme. The Electricity Commissioners, it appears, suggested that Skipton Council should apply to the Yorkshire Electric Power Co. for energy, but the Council seems rather to favour getting a supply from Keighley.

Stockton-on-Tees. — Loan Sanction. — The Town Council, on November 2nd, reported that a communication had been received from the Electricity Commissioners giving permission to borrow £33,647 in respect of the electricity works. The Corporation asked for £54,750, and the Commissioners pointed out that whilst they had allowed 80 per cent. of the estimated amount required, they would be prepared to consider further requirements when the actual expenditure had been ascertained.

Torquay.—New Station.—After hearing a report from its consulting engineer (Mr. C. H. Wordingham), the Town Council on Tuesday accepted the recommendation of the Electricity Committee to erect a power station at Newton Abbot as being the most suitable and economical site for the purpose. The possibility of the Great Western Railway electrifying its branch lines at Newton Abbot was mentioned. Mr. Wordingham regarded it as unfair on the part of the Electricity Commissioners, and contrary to their avowed policy, to call upon Torquay to bear the whole of the costs of the erection of the station. He would endeavour to secure information as to the motives of the Commissioners in making the proposal. It was estimated that a station to supply Torquay alone would cost £150,000, and that to make the necessary provision, would involve a 3s. rate. A comfortable way out of the financial difficulty was suggested in the advance of loans by the Commissioners for short periods, and finding a syndicate to build a station and sell the electricity produced.

Turton.—Loan.—Not having received approval from the Commissioners to an application for leave to extend the existing electricity works, the clerk of Turton District Council arranged an interview with Mr. Page, and the case was fully discussed and provisional sanction was given. Formal sanction has since been received to borrowing £17,000 for 25 years.

Warrington. — Position of Undertaking. —Within the next three or four years, said the chairman of the Electricity Committee, at a recent meeting of the Town Council, Warrington would have to decide the important question whether it would put down transformers for the purpose of reducing energy obtained from Liverpool or some other central place to a voltage suitable to the requirements of the district, or whether Warrington would be considered of sufficient importance to become a link in the chain of electrical generation. He hoped that Warrington would fall into line with other towns and cities, and realise the ideal of the better utilisation of waste heat, together with low temperature carbonisation plant so as to accomplish generation with such economy that every house might be supplied with electricity. The Electricity and Tramways Committee has decided to defer the question of obtaining loans for sub-stations, transformers and services, as well as the report on tenders for turbo-alternators.

Electric Motor Rents.—The Town Council has been discussing a proposal to increase the rent of electric motors hired from the Corporation, as at the present time, according to one member, it paid manufacturers to hire from the Corporation rather than buy motors of their own. The life of the motors, which cost from £20 to £30, was only ten or a dozen years. In reply, it was said that

the local electrical undertaking was coming to the stage that if there was a loss then the public had to meet it. The hiring charges had been revised, but if higher charges were wanted that could be seen to. Several undertakings had been deferred for the time being, owing to the difficulty of getting money.

Watford.—Loan Sanction.—The Urban District Council has received sanction to a loan of £18,420 for mains, services, switchgear, transformers, and meters.

Whitefield.—Street Lighting.—The Lancashire Electric Power Co. has given notice to the Urban District Council of its intention to terminate on June 30th next the contract for street lighting. The Council is to consider the question in March.

TRAMWAY AND RAILWAY NOTES.

Australia.—Melbourne.—The trials of new electric trains on the Williamstown line in August were not wholly successful, according to the Melbourne *Age*. It was proposed to run them in accordance with the standing steam locomotive schedules. The first two trains completed the journey successfully, but the third caused a breakdown. The middle pantograph caught up in the trolley wires, tearing them away for a distance of about 200 ft. It is thought that the entangling of the pantograph was due to the excessive rolling of the train heightened by a strong wind.

Cost of Railway Electrification.—Speaking in the House of Assembly, the Treasurer of Victoria, Mr. MacPherson, said he had received from the Victorian Railways Commissioners a communication which showed that the cost of the suburban railway electrification scheme would exceed the original estimate of £1,106,000 by £2,000,000. The scheme was approved in 1912. The expenditure up to August 31st, 1920, was £3,589,000, and the approximate cost of completing contract commitments would be £1,610,000. This made the probable cost of the scheme when complete £5,200,000, or broadly £2,000,000 more than was estimated in 1912. The additional expenditure due to war conditions, the Commissioners put down at £1,000,000, and the additional Custom duties, not contemplated when the original estimate was made, £250,000. The preference to British and Australian manufacturers, consequent upon the cancellation of American contracts, cost £100,000, and additional works, not provided for in the original scheme and plans, and "only rendered possible by the advance in engineering science," accounted for £550,000. Other works and minor adjustments accounted for £200,000.—*Reuter's Trade Service* (Melbourne).

Belfast.—Tramway Losses.—At a recent meeting of the Tramways Sub-Committee, Councillor Turner presiding, Mr. J. S. D. Moffett, general manager, submitted his traffic revenue account for the five months ending August 21st. This showed that, after all charges had been allowed for, there was a deficit of £9,924 for that period. The surplus for the corresponding period last year was £20,513. In April, May, and June the outlook was promising. Falling off took place with the outbreak of the labour troubles and the introduction of the Curfew Order. A Sub-Committee was appointed to go into the finance of the undertaking, make a report, and submit a supplementary estimate for the coming six months. In the meantime the Ministry of Transport is to be asked for permission to increase the minimum fare, which at present is 1d.

Bolton.—Wages.—A mass meeting of tramway employés has protested against the alleged delay of wage applications, which it was stated are put off from time to time. They state that they have received increases of 125 per cent., whilst the cost of living has gone up 170 per cent. The question was deferred until the National Industrial Council meets on November 12th.

Bradford.—New Railless Car.—A trial trip was run, on November 3rd, with an entirely new type of railless car. The car has been designed and built at the Thornbury works of the Corporation tramway department. The two new features are a covered top deck, accommodating 26 passengers, whilst the lower saloon holds 25, and adaptability to the ordinary permanent-way running, as well as the usual manner of running on the railless routes. Bradford tramway department prides itself on being a pioneer in railless traction, and its existing service of this kind is very successful. Mr. R. H. Wilkinson, the general manager, like his predecessor Mr. C. J. Spencer, who was Bradford's original tramway manager, has a great deal of confidence in the future of this mode of transport, and his confidence is strengthened now by the cheapness of establishment of new services as compared with that of ordinary tramway construction. Bradford has had railless services on certain routes for eight or nine years. The provision of a safe and comfortable covered upper deck is made possible by a wheel-base of 7 ft.; the sides of the car, especially the top portion, taper inwards, so that there is no danger of top-heaviness or of trouble in turning sharp curves on the road. The seating for 51 passengers compares with 60 on the rail cars and 29 on the existing railless cars. The vehicle is rubber-tired, and the seats are efficiently sprung. In running on the permanent way of rail tramways the negative trolley is disconnected and fastened down, and contact is made with the rails by fixing to the front of the car an iron shoe which fits the curved part of the rail and is connected by a short rod to the steering axle. The car is thereby steered automatically, as well as securing the earth contact. The working expenses of the new type of car are expected to be slightly higher than those of the ordinary tramcar, but when compared with the total cost of ordinary tramways—bearing in mind the expenditure of £54,000 per mile of double track in laying new line and overhead equipment—there is expected to be a saving of something like £50,000 per mile. The defects of railless cars, such as a certain amount of unreliability on steep hills or roads covered with frozen snow, are fully recognised in Bradford, where there is plenty of opportunity for experiencing both these difficulties, but it is believed that the new and heavier type of railless car will compare well with railled cars even on these matters. The railless cars have the advantage of being able to load and unload at the causeway edge, of being much quieter than railed cars, and of being easily removable, in case of breakdown, without holding up the service.

Buenos Aires.—Strike.—The personnel of the Rosario tramways has just declared a strike in order to obtain an increase of wages. The company replies that it will be necessary to raise the fares in order to meet the workmen's demands. The latter, however, have approached the municipality, requesting that the traffic should be placed under its supervision for a month in order to demonstrate that the company's profits will permit the solicited increase without prejudice to the shareholders' interests.—*Financial Times.*

Chile.—Railway Electrification.—According to advices from Santiago, tenders for the electrification of the first zone of the Chilean State Railways have been invited by the Chilean Government. The zone comprises the line from Valparaiso to Santiago, and the tenders, which are of two classes, will be opened on March 31st, 1921. The first class tenders is from those proposing to furnish the electric power; the second, those proposing to furnish rolling stock and equipment.—*Reuter's Trade Service* (Washington).

Continental.—Sweden.—Some time ago the Administration of the Swedish State Railways appointed a Commission to examine and report on the types of electric locomotives proposed for use in connection with the conversion to electric traction of the railway between Gothenborg and Stockholm. Four different kinds of locomotives had been suggested. The first was for shunting purposes, with a speed of 18·6 miles per hour; the second was a goods train locomotive with a hauling capacity of 900 tons and a speed of 37·2 miles; the third a passenger engine for a load of 300 tons and a speed of 49·6 miles; and the fourth an express locomotive for 500 tons and a rate of 62 miles per hour. The Commission has now presented its report, based upon a consideration of all the circumstances, including the experience gained on the electric railway between Gallivara and the Norwegian frontier. Having regard to the desirability of the electrical equipment for all the locomotives being of a uniform type, the Commission decided on the adoption of an A.C. motor of 400 H.P., at a speed of 830 R.P.M. It is suggested that the shunting type should be provided with such a motor, the goods and passenger locomotives be equipped with two motors, and the express locomotive with four motors. The Hydro-Electric Department has asked the Government to include estimates for 51,030,000 kronor in the Budget for 1921 for the extension of hydro-electric works, some of which are intended for use in connection with the supply of power to the Stockholm-Gothenborg Railway; and the Railway Administration has asked for a vote of 26,000,000 kronor for 1922, in addition to the 23,000,000 kronor already sanctioned for 1921, for the execution of works for the conversion of the same railway.

Lancaster.—Inquiry.—On November 2nd, Major Mount, R.E., conducted an inquiry into the circumstances attending a recent tramway accident, when a car on the Bowerham route got out of control and crashed into palisading at the Pointer Junction. The driver stated that his magnetic brake failed to act and the sanding gear was out of order. Just prior to the accident, he had pulled up at the Board of Trade stop, and the speed of the car never exceeded six miles an hour. He suggested that the sanding gear had been choked by tickets inserted through crevices in the seat by passengers. It was said that there had been laxity in initialling the car repairs book, but the tramway engineer said that he never allowed a car out unless it was in good running order. Witness also stated that the driver had not applied his hand brake, but tried instead a "last resort," which would lock both wheels immediately. Mr. Hartridge, representing an insurance company, thought that the rheostat under the platform had probably been fractured by a flying stone. In his opinion, careful application of the hand-brake would have stopped the car. The Inspector said that instructions to drivers contained a clause ordering the reduction of speed on a gradient to four miles per hour. The Inspector's report will be promulgated in due course.

Leeds.—Accident.—On the Wharfedale railless car route of the Corporation tramway department, on Saturday night, October 30th, the rear axle broke on the last car from Guiseley to Otley. Another car was brought from the Guiseley depôt to take the passengers forward, but just as it was rounding the broken car, a motor car from Otley collided with it, with the result that the front portions of both the railless car and the motor car were badly smashed and put out of action. The passengers had to walk home, and the road was not cleared until 3 o'clock on Sunday morning. The railless car services had not been too numerous for some time past, and these accidents left only one car to maintain the three-cornered service between Guiseley and Otley, and Guiseley and Burley, for some days.

Liverpool.—Goods Service.—A report on the conveyance of goods by tramcar is to be considered by the Tramways Committee at its November meeting.

London.—Overhead Equipment.—The London County Council has agreed to the overhead electrical equipment in connection with the reconstruction of the tramways in Burdett Road, Grove Road, &c., and the construction of the proposed new tramway in Well Street being provided and installed by Messrs. Clough, Smith & Co., Ltd., as an extra upon their present contract for similar work, at a total cost not exceeding £16,500.

Fares.—The Tramway Charges Advisory Committee was to sit on Tuesday last to inquire into the increased fares which have been in operation on the London County Council's system since September last. The Council was to ask for sanction for the present fares to remain in force until February, 1923.

Outer Circular Railway.—*The Times* recently devoted some space to a proposal made by Mr. Alexander Ross, a past-president of the Institution of Civil Engineers, to relieve the congestion of traffic in the Metropolis by a line coinciding approximately with a circle having a radius of 12 miles from Charing Cross. Passing over the Thames by a bridge at Kingston and under it by a tunnel at Purfleet, it would in its course circumscribe Hounslow on the west, Potters Bar on the north, Dagenham on the east, and Croydon on the south. It must of necessity pass under or over all the main lines entering London, and at the points of crossing junctions would be provided in two directions so as to permit trains to be received from any route and passed on to any other. The exchange of traffic would thus be effected outside the suburban zone, where there would be ample room for the construction of exchange stations, and where land would be less expensive than nearer London. The demolition of house property would also be largely avoided, and new areas would be opened up, offering increased facilities for industrial development and garden cities.

The total mileage would be about 85 miles, and Mr. Ross thinks that a complete double track could be provided at a cost of from £16,000,000 to £17,000,000. The line need not, however, be constructed in its entirety all at once; selected portions might be built from time to time, as demanded by the requirements of the traffic. As a matter of course the line would be worked by electricity.

Tube Mishaps.—There were two mishaps on London tubes between 9 and 10 o'clock on November 7th, which caused the stoppage of trains for a time and considerably interfered with home-bound traffic. A full train on the Bakerloo Railway came to a sudden standstill shortly after leaving Piccadilly Circus Station, owing, it is believed, to the fusing of a cable. All the lights in the train went out. The other mishap was on the Piccadilly Railway. The trouble originated in the motor compartment of a west-bound train. As the train entered South Kensington Station the compartment was seen to be on fire, and in order to extinguish it the electricity had to be cut off. Eventually the train was shunted to a siding, and traffic was resumed.

On the City and South London line on November 5th, a broken axle on a train at Stockwell Station blocked the line for over three hours.

Traffic Authority.—Sir E. Geddes, Minister of Transport, informed the House of Commons, on the 9th inst., that a Bill to establish a London traffic authority was at present being drafted by Parliamentary counsel, and would be submitted to the Cabinet as soon as it was ready.

Manchester.—Strike Abandoned.—On Friday night a mass meeting of Manchester and Salford tramcar drivers and conductors decided to cease work at noon the following morning unless their demand for compensation for men who have had to work short time in consequence of the cutting-down of the service during the coal strike, was granted. Fortunately, following a consultation between the men's representatives and the management, the expected strike was abandoned. The full tramway service was to be resumed on Tuesday morning, and Salford was to make the same arrangement.

Newport (Mon.).—Year's Working.—The report on the tramway undertaking for the period ended March 31st last announces that the total revenue amounted to £106,892, as compared with £81,608 in the previous year. Working expenses totalled £85,862, as against £64,718, leaving a gross profit of £21,030 (£16,890). The net result, after payment of all capital charges, was a profit of £10,617. Last year's figure was £5,666.

New Zealand.—Railway Electrification.—The contract for the electrification of the first section of the Midland Railway has been awarded to the English Electric Co., Ltd. This is an interconnecting section 8¼ miles in length from Otira to Arthur's Pass, and 5 miles of this distance is tunnel. The gradient is 1 in 33, making electrification the only practicable course. The system adopted is 1,500-volt D.C., with overhead contact. The power house will be situated at Otira station, and the power will be generated by geared turbine D.C. sets.

Tramway Extensions.—The Wellington (N.Z.) City Council proposes to borrow sums aggregating £1,708,915, to be expended on various undertakings connected with improvements and other city matters. Among the new works contemplated are:—Tramway extensions, new car-sheds and cars, and the erection of an electric power station at Evans Bay, estimated to cost £664,887. A tunnel through Mount Victoria, estimated to cost £161,250, and further tramway extensions in and around the city, estimated to cost £78,986.—*Reuter's Trade Service* (Melbourne).

Stockton-on-Tees. — Tramway Purchase. — It was reported to a meeting of the Town Council, on November 2nd, that the purchase of the local tramway service from the Imperial Tramways Co. was on the point of being accomplished. Alderman F. T. Nattrass regretted that Middlesbrough had refused to join with Stockton and Thornaby in seeking to secure an abatement in the arbitration award by an appeal on certain points. The award he added, was quite excessive, and represented £107,000 more for the undertaking than it could have been shown to have cost. The reply of Middlesbrough to the above statement is that its decision not to seek an abatement of the award was influenced by the consideration of the time which would be occupied before a decision was obtained, and the probability that, whoever won, the matter would be carried further.

York.—Railless Cars.—Last week a trial trip with one of the new railless cars was run between the electricity works and Heworth church. The new cars will be used first on the Parliament Street-Heworth route, and will supersede motor-omnibuses now in use.

TELEGRAPH AND TELEPHONE NOTES.

Cable Charges.—Reduction Unlikely.—In a written Parliamentary answer, the Postmaster-General says:—"The direct United States cable has been acquired by the Government for the purpose of duplicating the Imperial cable between this country and Canada and accelerating the service. With costs at their present level, I doubt if any early reduction of rates by this route will be practicable, but it is the only route by which 'deferred' telegrams can be sent to Canada and the West Indies at rates not exceeding half the charge for ordinary telegrams. Telegrams at deferred rates can also be forwarded for Australia. Oversea mail services are gradually improving as ships become available; but there is no prospect of an immediate return to pre-war speeds or costs."—*The Times.*

France.—New Wireless Stations. — The French Government has signed with the Cie. Générale de Telegraphie sans Fil a contract under which the company is authorised to establish wireless telegraph services for commercial traffic between France and all other countries of the world. The State will receive a share in the net profits after the shareholders have received a fair interest upon the capital of the company. The company has commenced the construction of two large wireless telegraphic centres which will be installed in the neighbourhood of Paris, one to be allocated to transoceanic communication and the other to communication with European countries. Pending the completion of these stations the services will be temporarily affected by the stations at Lyons and Bordeaux, with the assistance of the French Administration of Posts and Telegraphs, and according to the agreements and traffic regulations which the company has entered into. When the company's stations commence operations, the Government stations of Lyons and Bordeaux will cease to do any commercial service. Marconi's Wireless Telegraph Co., Ltd., is interested in the Cie. Générale de Telegraphie sans Fil.

Meteorological Information. — On November 1st, at 11.30 a.m., the Eiffel Tower, Paris, wireless station issued the first meteorological information since such messages were suspended on account of the war on August 2nd, 1914. It contained observations from 14 stations, including Valentia (Ireland), Stornoway, Copenhagen, Rome, and Algiers.

Pacific Cable.—Traffic Records.—A Treasury statement issued on the 8th inst. shows that during the year ending March 31st last the Pacific cable establishhd a new record, alike in revenue and the amount of traffic handled. The net traffic receipts amounted to £642,948, and exceeded those of 1918-19 by £88,436; £353,000 was appropriated to the reserve and renewal funds, and after meeting all other charges, there remained a surplus of £10,433, which will be applied in reduction of the outstanding balance of the original Treasury advance of £2,000,000. During the year over 9,000,000 paying words of international traffic were handled, over 750,000 words in excess of the total during the previous year, and 300,000 above the previous record number of paying words carried in 1916-17. In addition, approximately 2,320,000 paying words were carried between Australia and New Zealand and between those Dominions and the Pacific Islands, or 480,000 words in excess of the 1918-19 figures. No opportunity, it is stated, presented itself for reinstating the week-end cablegram service, and it is difficult at the present time to forecast the probable date on which it will become possible to resume it. There is, however, reason to anticipate some falling off in the volume of cable traffic within the next few months. If this takes place, and if the cable facilities of other routes are restored to their pre-war capacity, the pressure on the board's system will probably relax sufficiently to enable the week-end cablegram service to be resumed. Government traffic exchanged between the United Kingdom and Australia and New Zealand during the year under review amounted approximately to 2,200,000 words, approximately 1,300,000 words less than in the preceding year, but still about 2,000,000 words in excess of the number carried during the financial year immediately preceding the war.—*Daily Telegraph.*

Telephone Service.—The Postmaster-General, in reply to a question in the House of Commons, said that up to September 3rd last, 168,000 applications for the installation of telephones had been received since the armistice. Of that number, 126,000 installations had been completed; 7,000 were in course of construction; and 34,500 remained to be dealt with.

Wireless Stations.—Imperial Chain.—Sir J. Craig Financial Secretary to the Admiralty) informed the House of Commons that the wireless stations at present under the control of the Admiralty were not designed to form what was usually understood by the term "Imperial chain." No such chain at present existed. It was not possible to ensure passing a message by wireless from Bombay to England without at some point having to relay it over to a cable.

Wireless Telegraphy.—High-Speed Transmission.—Twelve wireless operators specially chosen by the Marconi Co. left London on Monday for Geneva, where they will be engaged in transmitting 50,000 words per day of Press reports of the League of Nations Conference which commences there on Monday next. They will attempt to transmit at the rate of 100 words per minute, and reception will be by means of phonograph "records."

Wireless Telephony.—Tests recently made between Keyport (N.J.), U.S.A., and Aberdeenshire, Scotland, show that wireless telephony worked by amateurs successfully carried the human voice and gramophone music across the Atlantic Ocean, with, it is said, only 100 watts transmission power.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review, *in which the "Official Notice" appeared.)*

OPEN.

Australia.—January 19th, 1921. Victorian Railways Department. Supply, delivery, and erection and testing, or, alternatively, supply and delivery of electric furnace and equipment, and/or, alternatively, for supply and delivery of equipment, and drawings for electric furnace. Particulars from the Agent-General for Victoria, London, S.W.—*Tenders.*

Western Australia.—December 28th. Postmaster-General's Department. Telegraph and telephone instruments and parts. (Schedule 689).

Tasmania.—December 13th. P.M.G.'s Department. Instrument parts, schedule T 301. (See this issue.)

Queensland.—P.M.G.'s Department. Testing and telegraph instruments (schedule 517). (See this issue.)

Belgium.—December 14th. The municipal authorities of Antwerp. Supply of a set, comprising electric motor and pump, for the raising of the bridge over the Royers Dock. Specifications can be obtained, at a cost of 2 francs, from the Hotel de Ville, Antwerp.

January 25th. Municipal authorities of Antwerp. Supply and erection of 20 5-ton electrically-operated cranes. Copies of the specification can be obtained for 5 francs from the Hotel de Ville, Antwerp.

Dublin.—November 16th. G. N. Railway Co. (Ireland). 12 months' supply of general stores, including electrical fittings, lamps, cable and wire, &c. (October 29th.)

Dewsbury.—November 16th. Electric lighting of the Dewsbury Temperance Hall, Foundry Street. Particulars from Caretaker. Tenders to Mr. J. W. Dixon, 35, Wellington Road.

Falkirk.—November 13th. Parish Council. Supply of stores for Blickbonny Home, including electric lamps. Mr. J. Macpherson, the Governor.

France.—November 19th and 26th. French State Railway authorities. Electrical material for the Ouest-Ceinture sub-station; two electrically-operated travelling cranes at the La Garenne electrical repair shops. Particulars from the Service Electrique, 88, Rue de Rome, Paris.

The French Posts and Telegraphs authorities in Paris have just invited tenders for the supply of 13,200 metres of paper-insulated cable, with 224 pairs of conductors, by conversion from old paper and rubber-insulated cables.

Boulogne-sur-Mer.—November 16th. Chambre de Commerce. Supply and erection of six large electric travelling cranes for the Nord Quay of the Loubet Dock.

Grimsby.—November 29th. Electricity Department. Sub-station converting plant, traction converting plant, comprising one 250-kw. and one 500 kw. converter, and one 250/300-kw converter. (See this issue.)

Leeds.—December 13th. Electricity Department. Three-phase switchgear for the generating station. (See this issue.)

London.—Metropolitan Asylums Board. November 24th. Alterations and extensions to the electric lighting and power installations in the motor workshops at the head ambulance station, Carnwath Road, Fulham; hot water supply apparatus at the Eastern Hospital, Homerton; continuous drying machine at Leavesden Mental Hospital. (See this issue.)

New Zealand.—January 17th. Napier Municipal Council. Supply of one 500-kw. gas-electric generating set.—*Reuter's Trade Service* (Wellington).

Plymouth.—November 30th. Electricity Department. H.T. and E.H.T. switchgear; oil-cooled transformers. (See this issue.)

Stockton-on-Tees.—November 15th. Electricity Department. One new traction switchboard; one rotary converter panel and busbars. (November 5th.)

CLOSED.

Australia.—Melbourne.—City Council. Accepted:—

1,000 cast-iron house cut-out boxes, 2,500 fuse cartridges, 1,000 porcelain bases, £940. Tombs & Howcroft (Pty.), Ltd.

Sydney.—City Council. Recommended:—

Spare parts for coal conveyors, £948.—Lowe Bros., Ltd.
Airbreak switches, £881.—D. B. Armstrong.

River Latrobe Hydro Electric Co., Victoria. Accepted:—

Boving water turbine and a Holmes generator, £4,578.—Strachan, Murray and Shannon.

Commonwealth.—P.M.G.'s Department. Accepted:—

Copper wire for the various States, £18,546.—Metal Manufacturers, Ltd.—*Tenders.*

Belgium.—There was keen international competition for the contracts recently given out for cables by the Belgian State Railway authorities in Brussels. Tenders were invited for altogether 15 lots, and among the British firms tendering were the B. I. & Helsby Cables, Ltd., and the Metropolitan-Vickers, Ltd.; they were, however, underbid by Belgian firms.

Blackpool.—

Electrical installations in the 160 houses erected by the British Alizarine Co., Ltd., under the housing scheme.—G. Morrison.

Bristol.—Board of Guardians. Accepted:—

Electric lighting at Eastville Institution, £1,619.—Imperial Electrical Co.

London.—Walthamstow.—Electricity Committee. Recommended:—

Two-water-tube boilers, economisers mechanical stokers, superheaters and the necessary pipework, £27,950.—Babcock & Wilcox, Ltd.
One 5,000-kw. Brush-Ljungström turbo-alternator, with condensing plant, £48,600.—Brush Electrical Engineering Co., Ltd.
Cooling tower, £3,590.—C. Bradshaw & Co.
One 1,000-kw. and one 1,500-kw. motor-converter, £17,800.—Bruce Peebles and Co.
E.H.T. switchgear, £3,039.—British Thomson-Houston Co., Ltd.
L.T. switchgear, £1,233.—A. Reyrolle & Co., Ltd.
Cables, £1,646.—W. T. Henley's Telegraph Works Co., Ltd.

Manchester.—Electricity Committee. Barton Power Station:—

One 25,000-kw. turbine and one 25,000-kw. alternator, condensing plant and condensate heater.—Met.-Vickers Electrical Co., Ltd.
Sub-contractors for condensing plant and condensate heater.—Richardsons, Westgarth & Co., Ltd.
One 1,000-kw. turbo-alternator and additional switchboard.—British Thomson-Houston Co., Ltd.
Six boilers, &c.—Babcock & Wilcox, Ltd.
Sub-contractors for fans.—Davidson & Co., Ltd.
Motors.—Lancashire Dynamo & Motor Co., Ltd.
Extensions to the coal conveying plant.—W. J. Jenkins & Co., Ltd.

New Zealand.—Further to our note on page 465 of our October 8th issue, the net tenders received for the electrification of the Otira Tunnel were:—

National Electric & Engineering Co., Ltd., £284,012.
English Electric Co. of Australia, £264,073 (accepted).

The contract includes the electrical equipment of a coal-fired generating station of 4,000-h.p. capacity at Otira, the supply of six electric locomotives, the electrification of the track between the present steam terminus at Otira and Arthur's Pass, including the electric lighting of the tunnel and the equipment of the necessary workshops at Otira. It is expected that the whole work will be completed, and the electrified lines ready for operation, in about 18 months.—*Auckland Weekly News.*

FORTHCOMING EVENTS.

Electro-Harmonic Society.—Friday, November 12th. In the Great Hall, Cannon Street Hotel, E.C. At 8 p.m. Ladies' night.

Physical Society of London.—Friday, November 12th. At the Imperial College of Science, South Kensington, S.W. At 5 p.m. Ordinary scientific meeting.

Association of Engineers-in-Charge.—Friday, November 12th. At the Crown Room, Holborn Restaurant. At 6 p.m. Ladies' night.

Manchester Association of Engineers.—Saturday, November 13th. At the Memorial Hall, Albert Square. At 7 p.m. Paper on "The Education Act of 1918 as it affects the Engineering Industry," by Mr. S. Hey. Discussion on "Liquid Pressure of Iron in Moulds," introduced by Mr. A. H. Goodger.

Chief Technical Assistants' Association.—Saturday, November 13th. At Anderton's Hotel, Fleet Street, E.C. At 3 p.m. Discussion on Mr. Murdoch's paper on "Dust Destructors."

Birmingham Electric Club.—Saturday, November 13th. At the Grand Hotel, Colmore Row. At 7 p.m. Paper on "Some Aspects of Modern Works Management," by Mr. H. C. Young.

Institution of Electrical Engineers.—Monday, November 15th. Informal meeting at the Institute of Patent Agents, Staple Inn Buildings. At 7 p.m. Discussion entitled "Is Specialisation a Danger?" to be opened by the President.

Thursday, November 18th (postponed from November 11th). At the Institution of Civil Engineers, Gt. George Street, S.W. At 6 p.m. Inaugural address by the President, Mr. Ll. B. Atkinson. Presentation of premiums.

(North-Midland Centre.)—Tuesday, November 16th. At the Hotel Metropole, Leeds. At 7 p.m. Chairman's (Mr. C. J. Jewell) address. Smoking concert.

(East-Midland Sub-Centre).—Tuesday, November 16th. At the Technical College, Loughborough. At 6.45 p.m. Paper on "Notes on Electricity in Agriculture and Plant Life," by Mr. W. T. Kerr.

(Students' Section).—Friday, November 19th. At the City and Guilds (Engineering) College, South Kensington, S.W. At 6.30 p.m. Opening address by Mr. C. C. Paterson on "The Incandescent Electric Lamp from the Inside."

Wireless Sectional Meeting.—Wednesday, November 24th. At the Institution of Civil Engineers, Gt. George Street, S.W. At 6 p.m. Address by Dr. W. H. Eccles, Chairman of the Wireless Section.

Institute of Marine Engineers.—Tuesday, November 16th. At the Institute, the Minories, E. At 6.49 p.m. Paper on "Oils for the Internal-Combustion Engine," by Mr. J. L. Chaloner and Mr. T. McKenzie.

Royal Society of Arts.—Wednesday, November 17th. At John Street, Adelphi. At 8 p.m. Opening meeting. Address by the Chairman (Mr. A. A. Campbell-Swinton, F.R.S.) on "Wireless Telegraphy and Telephony."

Liverpool Engineering Society.—Wednesday, November 17th. At the Royal Institution, Colquitt Street. At 8 p.m. Paper on "Prevention of Accidents in Industry," by Mr. C. K. Atkinson.

Chelmsford Engineering Society.—Thursday, November 18th. At the East Anglian Institute of Agriculture. At 7 p.m. Paper on "Practical Turbine Engineering," by Mr. G. Barlow.

Edinburgh Electrical Society.—Friday, November 19th. At the Philosophical Institute. At 8 p.m. Paper on "Medical Electricity," by Dr. W. Hope Fowler.

Institution of Mechanical Engineers.—Friday, November 19th. At the Institution, Storey's Gate, S.W. Paper on "Sterilisation of Water by Chlorine Gas," by Capt. J. S. Arthur.

Junior Institution of Engineers.—Friday, November 19th. At 39, Victoria Street, S.W. At 7 p.m. Annual general meeting. Discussion on "Economical Transmission of Power," to be opened by Mr. G. H. Ayres.

NOTES.

Trade with Soviet Russia.—The Federation of British Industries, after considering the draft commercial agreement to be concluded between the British Government and the Soviet Government of Russia, and Mr. Bonar Law's statement in the House of Commons on October 26th, has approached the Foreign Secretary, pointing out that the terms are incompatible with the restoration of satisfactory commercial relations. In effect, the Soviet Government is permitted to repudiate responsibility for liabilities incurred by it and by its predecessors, and no provision is made for the compensation of British subjects who have suffered in person or property through the Russian revolution. The Federation therefore urges that no agreement can prove effective unless it contains a recognition by the Soviet Government of liability for existing debts, provision for the payment of interest on those debts, an undertaking for the repayment of the principal, recognition of the principle of compensation and provision for its prompt payment, and the establishment of a clearing-house system to deal with debts and interest thereon.

A Big Order from Spain.—Referring to the "Note" which appeared in our last issue, page 594, under the heading, "Electrical Developments in Spain," Messrs. Boving & Co., Ltd., inform us that they recently secured a very important order for a water turbine plant from the Sociedad Hidroelectrica Ibericat Bilbao. This covers two 20,500-B H.P. vertical-shaft Pelton wheels, which will operate under a head of water of 450 metres and will run at a speed of 500 R.P.M., together with automatic speed governors, the necessary distribution pipes, and a hydraulically-operated automatic sluice valve.

The plant is to be installed at the Rio Cinca power station, driving electrical alternators.

These machines rank amongst some of the largest ever built, and it is of special interest to note that the order was secured against exceptionally heavy Continental and American competition.

Artificial Coal.—According to the journal *Elektrizitat* an engineer named Bauschleicher, has succeeded in manufacturing artificial coal of great heating capacity. It can be manufactured from peat in a wet state, which has been taken direct from the cutting. The new fuel, which is called "gasol-coal," has a heat capacity of 7,500 units, burns with a bright flame, and is made for use with wood or other fuel. It is also possible by this process to manufacture coke of lesser heat capacity. This artificial coal is stated to have the added advantage that it burns to ashes and leaves no cinders.—*The Times.*

Electricity Supply Rifle League.—The following are the results of the October matches:—

Shoreditch	587	St. James'	519
Brompton	561	Hackney	549
Shoreditch...	590	Metropolitan Co.	577
"	583	Central	566
Central	567	Brompton	547
City Co.	562	"	559

Shoreditch is at the head with 20 points, and Metropolitan second with 18, each having lost only one match. The City Co., Central, and Hackney are next in order.

Fatalities.—A public inquiry was held in Linlithgow Sheriff Court on Wednesday last week, into the circumstances attending the death of Alexander Ellis, a shale miner. Evidence was given to the effect that Ellis was going on night shift work at the shale mine of Deans, and was about to enter the bothy at the head of the mine, when, on taking hold of the handle of the bothy door, he received an electric shock from the effects of which he died almost immediately. A young miner who, though not cited, elected to give evidence, stated that he had attached a piece of wire to the electric fuse and put the other end through a hole in the door, without any intention of doing injury to Ellis or anyone.

The jury returned a verdict to the effect that the death of Ellis was caused through mischievous tampering with an electrical installation by the young miner, but they did not consider that he had any knowledge of the likelihood of any fatal termination, or that he meant the result for any particular party.

Enthusiasm for his work was mentioned as the possible cause of the death of William John Orr, electrical student (21), of Sheffield, who was killed at the works of Messrs. Vickers, Ltd., on October 27th. John Middleton, in charge of the electricians at the testing bench, related to the Coroner that a fault occurred on one of the regulators on a motor which involved stopping the machine. The supply was cut off, but some of the parts of the machine would still be alive owing to the momentum of the revolving machine. While he was removing the insulating plugs, he heard a scream, and turning round he saw Orr collapse into a fitter's arms. A verdict of "Accidental death" was recorded.

Thomas Howarth, 79, of Vickerstown, was knocked down by a Barrow Corporation electric tramcar last week, and died an hour later from injuries received. At the inquest on Tuesday, the evidence showed that the deceased was rather deaf, and walked across the tramway lines as the car was approaching. James Taylor, the driver of the car, said many people were crossing from one side of the street to the other, and that was why he was sounding his bell. He did not see the deceased until he was two yards from him and he pulled up in four yards. Other evidence showed that the life-guard on the front of the car dropped into position, but the deceased fell sideways and was caught beneath the offside step of the car and dragged some distance. The Coroner left the Court to view the car, and on his return, expressed the opinion that the evidence of the witnesses had been clear, and, in finding that the deceased met his death accidentally, he exonerated the driver from all blame. He pointed out that all that drivers had to do was to drive with reasonable and proper care. He suggested, however, that the step on this particular tramcar should be raised a little. Had it been higher, the deceased might not have been dragged along after falling. On behalf of the Barrow Corporation, the Town Clerk extended sympathy to the bereaved relatives.

Appointments Vacant.—Shift engineer (£5 10s.), overhead linesman (£5), for the Neath Rural District Council Electricity Department; electrical inspector (650 Rs. per month), assistant electrical foreman (425 Rs. per month), for the East Indian Railway; draughtsman, for the Northampton Electric Light and Power Co., Ltd.: rolling stock superintendent (£350), for the Wigan Corporation Tramways Department; assistant telegraph engineer, $360 per month (dollar = 2s. 4d.), for the Post and Telegraph Department of the Government of the Malay States. See our advertisement pages to-day.

National Electricity Supply.—On the Order Paper of the House of Commons of November 9th there was notice of a question by Mr. Seddon to ask the Minister of Transport whether the work of carrying out the various electricity schemes prepared under the Electricity (Supply) Act, 1919, could be put in hand at once in order to assist in providing immediate work for the unemployed, and also to supply the much-needed electric power for new industries which will also provide increased employment in the future.

The Electrical Trades Benevolent Institution.—The Annual Festival will be held on Wednesday, December 15th, at the Connaught Rooms, when Mr. E. Manville, M.P., will preside.

County of London Royal Engineer Volunteers.—The disbandment of the County of London R.E. Volunteers, London Army Troops Companies, and the distribution of the funds, are now complete. In January last, £94 8s. 5d. from the funds of what was known as the "Engineering Institutions Company," was paid through Sir John Snell to the Benevolent Funds of the Institutions of Civil, Mechanical and Electrical Engineers. After the final wind-up of the Corps, as a whole, there was a balance of £64, and this has been handed to Earl Haig's Fund.

Electric Tricycles.—The Swiss Postal authorities are about to put into service in Geneva and Berne a number of electric motor-tricycles for the delivery of express letters. The machines will be fitted with a small battery of accumulators, and are designed to attain a speed of 15 miles per hour.

Electrically-Propelled Ships.—Following the success of the electrically-propelled battleships of the U.S. Navy, the U.S. Shipping Board is to equip 10 large freight vessels on the same lines. The *Eclipse*, an 11,800-ton (deadweight) cargo vessel which was originally turbine-driven, and has been converted, recently attained a speed of 11·5 knots on a trial trip from the South Brooklyn Yard of the Tobo Jack Basin out to sea, and the American General Electric Co. has been given a contract to equip 10 vessels.—*Lloyd's List.*

British Chambers of Commerce in China.—The second annual conference of British Chambers of Commerce in China and Hong Kong opened at Shanghai on the 3rd and closed on the 6th inst. Mr. Clive, British Charge d'Affairs, made a speech, in which he announced that the Chinese Foreign Minister had given assurances that the mandate terminating official relations between China and Russia was not intended to cause the slightest injury to any British interests, and had promised sympathetically to listen to any complaint on the subject. Mr. Clive added that His Majesty's Government would do its utmost to give effect to any constructive proposals made by the Conference. Mr. Archibald Rose, Commercial Secretary to the Legation, gave an optimistic review of the industrial situation in China. He said that, in spite of the unrest throughout the country and the financial disorganisation in Peking, real development was proceeding apace. At the same time a spirit of revolt against foreign ascendency was springing up. This did not denote an anti-foreign animus, but meant that the Chinese desired to work "with us and not for us." Mr. Rose advised British enterprise to meet the Chinese half-way in this co-operative movement. Mr. Holyoak, member of the Hong Kong Legislative Council, urged that a really powerful wireless station should be erected with all speed in Hong Kong, connecting the island with India and Honolulu, and available for commercial use in peace time. He declared that the competition from other nations, already possessing more powerful wireless installations, rendered the carrying out of his suggestions vitally necessary for Imperial as well as trade interests.—*Reuter's Trade Service* (Shanghai).

A Duddell Memorial.—We are informed that the wish has been generally expressed that there should be a memorial to the late Mr. W. Duddell, C.B.E., F.R.S., by whose death in November, 1917, physical science suffered a severe blow.

It is proposed that the memorial should take the form of a medal to be awarded periodically by the Council of the Physical Society, and at its discretion, to those who have advanced physical knowledge by the invention or design of scientific instruments, or of materials used in their construction. If sufficient funds are available after paying for the cost of the dies, and after providing for the cost of striking the medals, it is proposed to form a fund to be devoted to the foundation of scholarships or prizes to be awarded to students of the Physical Society under conditions to be determined by the Council.

Subscriptions should be forwarded to the hon. secretary, Mr. Robert S. Whipple, 15, Creighton Avenue, Muswell Hill, London, N. 10.

Constitution of the Elements.—An interesting new instrument is reported to be in operation at the Cambridge University Physical Laboratory in connection with an attempt to indicate the constitution of the elements. One of the results which it appears to have yielded is that "chlorine is not an element." It seems either to be a compound or, perhaps, a substance which is gradually changing, as radium does. The instrument is said to be in some of its features a development of Prof. J. J. Thomson's well-known device, and it enables the rays given off by substances to be photographed. Mr. Aston is named as the originator of the new instrument, and he is said to be working in conjunction with Dr. Rutherford and Prof. J. J. Thomson.

Overtime Ban.—According to the *Daily Herald* the Electrical Trades Union, London District, has resolved by a ballot vote to prohibit all its members from working overtime, except in emergency and by permission of the London District Committee, in order to reduce unemployment in the area.

INSTITUTION NOTES.

Institution of Electrical Engineers.—On account of the closing of streets for the purpose of controlling the crowds which the authorities expected in the central part of Westminster on the 11th inst., in connection with the unveiling of the National Cenotaph, &c., and the impossibility of obtaining access to the building of the Institution of Civil Engineers, it was decided to postpone the opening meeting of the session to Thursday, November 18th, when the meeting will be held at the Institution of Civil Engineers at 6 p.m., and the President, Mr. Ll. B. Atkinson, will deliver his inaugural address.

The arrangements for holding the first meeting were, of course, made and published by the Council long before the official arrangements for the observance of Armistice Day were settled; the latter were not announced until Monday last.

Wireless Section.—The wireless sectional meeting, announced for November 17th, has been postponed to November 24th (at the Institution of Civil Engineers at 6 p.m.).

I.E.E. Benevolent Fund.—The Fund has benefited by a donation, through Captain S. T. Pemberton, of £30 0s. 9d., being the balance of the Corps Funds of the late Warwickshire Royal Engineer (V) Corps Signal Company.

The Council of the Institution has been informed that its premises will be vacated by the Government before the end of December, and that immediately afterwards the Office of Works will commence the work of repairing and cleaning the building, with a view to the Institution having vacant possession of the premises early in the New Year.

The programme for the first half of the session contains the following items:—

November 18th.—Inaugural address by the President, Mr. Ll. B. Atkinson.
November 25th.—Papers on "The Distribution of Electricity," by Mr. W. B. Woodhouse, and "Some Economic Aspects of E.H.T. Distribution by Underground Cables," by Mr. R. O. Kapp.
December 9th.—Adjourned discussion on the foregoing papers.
December 16th.—Discussion of "Report on the Heating of Buried Cables."
January 13th.—Kelvin Lecture on "Electrons," by Sir W. Bragg, K.B.E., F.R.S.
January 27th.—Paper on "Temperature Limits of Large Alternators," by G. A. Juhlin.

Wireless Section.

November 24th.—Address by the Chairman of the Section, Dr. W. H. Eccles.
December 15th.—Paper on "The Range of Wireless Stations," by Capt. R. C. Trench, R.E.

Informal Meetings.

November 15th.—Discussion opened by the President.
November 29th.—Discussion on "Electrical Transmission on Petrol Vehicles," opened by Mr. A. F. Harmer.
December 13th.—Discussion on (1) "Percentage and Accuracies." (2) "Meter Constants and Standards," and (3) "Nameplates," opened by Mr. W. J. Minton.
January 17th.—Discussion on "The Mental Equipment of an Engineer," opened by Mr. P. Pitt.

North-Midland Centre.

November 10th.—Address by the Chairman, Mr. C. J. Jewell, and smoking concert.
November 22nd.—Paper on "Permanent Magnets," by Prof. E. H. Crapper.
December 14th.—Discussion on Report on the Heating of Buried Cables.
January 11th.—Visit of the President.
January 25th.—Paper by Mr. Woodhouse.
February 8th.—Paper by Mr. Juhlin.

North-Western Centre.

November 9th.—Address by Chairman, Mr. J. Frith.
November 23rd.—Papers by Mr. W. B. Woodhouse and Mr. R. O. Kapp.
December 7th.—Report on Buried Cables.

Scottish Centre.

November 9th.—Address by the Chairman, Mr. J. E. Sayers.
December 14th.—Paper by Mr. Woodhouse.

The annual report of the Committee records the formation of sub-centres in Aberdeen and Dundee, and the successful summer outing at Kinlochleven. The membership has increased from 386 in 1919 to 523 in 1920.

The report of the Scottish Students' Section refers to the visit of the London Students in July, and states that the office-bearers for 1920-1921 are Mr. F. H. Whysall, chairman; Mr. D. J. M'Kellar, vice-chairman; and Mr. W. K. Fleming, hon. secretary.

Western Centre.

The first ordinary meeting of the session was held at Bristol on November 8th. The Chairman, Mr. A. Ellis, presided. The incoming Chairman (Mr. A. J. Newman, Deputy Electrical Engineer, Bristol Corporation Electricity Department) was inducted to the chair, and delivered his inaugural address, giving a general survey of recent engineering progress and suggestions regarding future developments. He drew attention to the fact that the Institution of Electrical Engineers was growing in membership, utility, and prestige, and, largely as a result of this, the great importance of engineering to the general community was becoming more publicly appreciated. He encouraged young engineers to take an active part in the work of the Institution, stating that they would not be loyal even to their own personal interests if they failed to embrace the opportunities and benefits which it at present afforded.

Students' Section.—The following programme has been arranged:—

November 19th.—Opening address, "The Incandescent Electric Lamp—from the Inside." Delivered by Mr. C. C. Paterson, O.B.E., M.I.E.E.
November 26th.—Paper on "Electricity and the Papermaking Industry," by Mr. A. J. C. Watts.
December 3rd.—Discussion on "The Modern Tendency to Trusts. Is it Beneficial?" Opened by Mr. A. Serner.
January 21st, 1921.—Paper on "Electric Welding," by Mr. H. J. Howard.

Royal Society of Arts.—The arrangements for the present session, which opens on Wednesday, November 17th, at 8 p.m., with an address by the Chairman, Mr. A. A. Campbell Swinton, F.R.S., on "Wireless Telegraphy and Telephony," include the following papers:—

March 7th, 14th and 21st, at 8 p.m.—"X-rays and their Industrial Applications," by Major G. W. C. Kaye.
April 11th, 18th and 25th, at 8 p.m.—"Recent Applications of the Spectroscope and the Spectrophotometer to Science and Industry."

The following papers to be read after Christmas:—

Sir M. Samuel, Bart.: The general position of the oil question.
A. F. Baillie, Chief Engineer, Technical Department Anglo-Mexican Petroleum Co.: Oil burning methods in various parts of the world.
A. Abbott (Department of Science and Industrial Research): The origin and development of the research associations established by the department.
Sir H. Jackson, F.R.S.: Research in scientific instrument making.
Dr. W. Cramp, M.I.E.E.: Pneumatic elevators in theory and practice.
Dr. C. S. Myers, F.R.S.: Industrial fatigue.
Sir C. H. Bedford: Industrial (including power) alcohol.
Prof. W. A. Bone, F.R.S.: Brown coals and their lignites: their importance to the Empire.

Institute of Transport.—A congress is to be held by the Institute at Manchester some time this month.

The Royal Society.—At the meeting on November 4th, Sir J. J. Thomson, O.M., President, in the chair, a paper was read by Prof. H. Lamb, F.R.S., on the "Vibrations of an Elastic Plate in Contact with Water." The subject is of interest in connection with submarine signalling. Prof. H. M. Macdonald, F.R.S., read a paper on "The Transmission of Electric Waves around the Earth's Surface."

The following are recommended by the president and council for election to the council at the meeting on November 30th:—

President: Professor C. S. Sherrington, M.A., M.D., Sc. D.
Treasurer: Sir David Prain, C.M.G., C.I.E., M.A., LL.D.

Secretaries: Mr. W. B. Hardy, M.A., and Mr. J. H. Jeans, M.A.

Foreign Secretary: Sir Arthur Schuster, Ph.D., Sc. D., LL.D.

Chelmsford Engineering Society.—On Thursday, November 4th, Mr. Dann in the chair, a very interesting and instructive lecture was given on "Gauges and their Manufacture" by Mr. Pochin, B.A., before a large attendance of members at the East Anglian Institute of Agriculture. The paper gave a comprehensive survey of the various compositions and subsequent treatment of steels in the manufacture of gauges, including the different effects produced with the varied methods of hardening and the importance of the correct and careful attention given to the ageing of the material. He expressed his appreciation towards Messrs. Hoffmann Co. for their supply of various samples of steels which enabled him to carry out a considerable amount of war work in connection with the manufacture of gauges, &c. A discussion followed.

Edinburgh Electrical Society.—On Thursday, October 21st, a large number of the members visited the offices of *The Scotsman*, Edinburgh, and were much interested in the Morse translating machines and the various novel applications of motors to newspaper work.

On Friday, November 5th, Mr. Basil A. Pilkington, F.R.S.E., lectured to the Society on "Some Incidental Uses of Electricity." The lecture was illustrated by practical demonstrations and coloured diagrams. The subjects dealt with included novel electrical effects for stage and decorative purposes, apparatus for automatic temperature control, systems of "push-button" control, and the advantages of using bells on high-pressure circuits. This stimulating lecture was much enjoyed, and a discussion followed.

On Friday, 19th inst., Dr. W. Hope Fowler, F.R.C.S., Chief Medical Electrician at the Royal Infirmary, Edinburgh, will lecture on "Medical Electricity" at the rooms of the Society in the Philosophical Institute, Queen Street, Edinburgh.

Institute of Physics.—An institute with the above title, from which the word "Limited" has been omitted by licence of the Board of Trade, was registered on November 1st as a company limited by guarantee with the objects of elevating the profession of the physicist and advancing and diffusing a knowledge of physics, pure and applied. The management is vested in a board of four persons to be appointed by each of the Faraday and Optical Societies, and seven by the Physical Society. Other societies which may enter into participation during the existence of the first board will have the right to nominate an additional member. The secretary is Mr. W. Buchanan, of 66, Lincoln's Inn Fields, W.C.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

In honour of his silver wedding anniversary, Mr. G. H. Roberts, M.P., joint president of the Industrial League, was on Friday, last week, presented with a silver cigar-cabinet from Colonel Sir William Dupree (an honorary life member of the League), and a testimonial from the members of the staff.

Mr. H. H. Couzens, general manager of the Toronto Hydro-Electric System, has also been appointed general manager of the Toronto Transportation System. The franchise of the Toronto Railway Co. expires in about a year, and the recently-appointed Transport Commission desires to have all arrangements perfected in advance to take over the system, so as to avoid confusion as much as possible due to change of management. Mr. E. M. Ashworth, assistant general manager of the Hydro System, has been made acting general manager with a view to giving Mr. Couzens more freedom in the meantime to attend to transportation matters.—*Electrical News* (Canada).

Mr. S. L. Pearce, chief engineer of the Manchester Corporation electricity department, together with Ald. W. T. Dagnall, the chairman of the committee, arrived home from the States on November 5th, after a trip to study American methods of generating and transmitting power. Ald. Dagnall and Mr. Pearce had a very strenuous time during their visit, travelling over 10,000 miles, and inspecting most of the more up-to-date installations. "So far as generation is concerned," Mr. Pearce says, "apart from the fact that America is operating on a much larger scale than ever, and utilising much larger plant, there is not a very great difference in the practice of the two countries. If one compares the modern plant to be found in America with the modern plant either operating in this country or being planned, we are in no way behind. When the present financial strain is eased, however, America will be on the eve of tremendous electrical development."

Remarking on the fact that in the States some undertakings supplying both gas and electricity are controlled by the same parent or holding company, Mr. Pearce says this does not appear to have the effect of lessening competition between the two utilities, but has a tendency for the gas concerns to concentrate in the direction of cookers, heaters, &c., and leave the electricity stations to cater for lighting and industrial power purposes.

Mr. G. W. Partridge has been appointed managing director of the London Electric Supply Corporation, Ltd.

Dartford U.D.C. has rejected a recommendation to increase the salary of the electrical engineer from £500 to £650 per annum.

Mr. A. Hugh Seabrook, M.I.Mech.E., M.I.E.E., is now practising as a consulting engineer at 11, Queen Victoria Street, London, E.C.4, specialising in fuel economy in connection with heating and power plant, and advising on electric power, heat, and light installations. As most of our readers know, he was formerly engineer and general manager of the Barking electricity supply and light railways, West Ham electricity supply, and St. Marylebone electricity supply, and made his mark as an authority on the conduct of such undertakings. He has our best wishes for his success in his new rôle.

It is announced in *Nature* that Mr. F. S. Spiers, secretary of the Faraday Society, was recently appointed by the King an Officer of the British Empire (O.B.E.), and reference was made to this honour at the opening of the joint meeting on the physics and chemistry of colloids. Mr. Spiers has been responsible for the organisation of the many valuable joint conferences arranged by the Faraday Society during Sir Robert Hadfield's presidency; he was secretary of the British Scientific Products Exhibitions organised in 1918 and 1919 by the British Science Guild, and is secretary of the Institute of Physics, which, there is every reason to believe, will eventually occupy a very strong position among scientific bodies.

Obituary.—Mr. T. F. Fuller.—The death has taken place at Bexley Heath (Kent), of Mr. Tom Frederick Fuller, for many years partner, with his brother, in the firm of John C. Fuller & Son, electrical engineers, of the Woodland Works, Bow, E. He was in his 93rd year, and prior to joining his brother he was with the Electric Telegraph Co., The India Rubber, Gutta Percha, and Telegraph Works Co., Ltd., of Silvertown, and W. T. Henley's Telegraph Works Co., Ltd. He retired from the firm in 1908.

NEW COMPANIES REGISTERED.

John Furlong & Sons (1920), Ltd. (5,062).—Private company. Registered in Dublin October 26th. Capital, £120,000 in £1 shares. To carry on the business of generators and suppliers of electricity. The subscribers (each with 100 shares) are: M. G. Haughton, Woodlands, Glanmire, Co. Cork; C. C. Mercier, Ardmachree, Limerick. The first directors are: M. G. Haughton, C. C. Mercier, J. P. Goodbody, senr., J. P. Goodbody, junr., and G. E. Goodbody. Secretary: C. C. Mercier. Registered office: Lapp's Quay, Cork.

Oldham & Son, Ltd. (171,213).—Private company. Registered November 3rd. Capital, £30,000 in £1 shares. To carry on the business of mining, mechanical, and electrical engineers, manufacturers of and dealers in miners' lamps and colliery requisites, founders, machinists, manufacturers and patentees of primary and secondary batteries and hardware, &c., and to acquire the business carried on by O. Oldham, at Denton, Lancs., as "Oldham & Son." The first directors are: O. Oldham, Cambridge House, Highfield, Gorton, Manchester; G. Oldham, Sunny Bank, Haughton Green, Denton, Manchester; E. C. Oldham, Cambridge House, Highfield, Gorton, Manchester; J. Oldham, Cambridge House, Highfield, Gorton, Manchester. Secretary (pro. tem.): J. J. Hammond. Registered Office: 36, Hyde Road, Denton, near Manchester.

Thomson Woollard, Ltd. (171,146).—Private company. Registered October 30th. Capital, £4,000 in £1 shares. To carry on the business of manufacturers and repairers of and dealers in motor accessories and other mechanical and electrical contrivances, &c. The subscribers (each with one share) are: H. Thomson, Alexandra Works, Brent View Road, West Hendon, N.W.9, engineer; G. Woollard, Alexandra Works, Brent View Road, West Hendon, N.W.9, engineer. The first directors are: H. Thomson and G. Woollard. Secretary: G. Woollard. Registered office: Alexandra Works, Brent View Road, West Hendon, N.W.

Perfection Electrical Co., Ltd. (171,252).—Private company. Registered November 5th. Capital, £1,000 in £1 shares. To carry on the business of marine, mechanical, civil, electrical, steam, gas, ventilation, and hydraulic engineers, manufacturers of motors, machinery, plant, and tools, agents or brokers for or in connection with the sale of motors of all kinds and other electrical and engineering appliances, &c. The first directors are: F. W. Martin, 54, Bruce Castle Road, Tottenham, N. (director Walton Shipping Co., Ltd.; H. E. O. Ellis, 52, South Croxted Road, Dulwich, S.E. (director C.E.C., Ltd.). Registered office: 1, Emerald Street, W.C.1.

Brentwood District Electric Co., Ltd. (171,224).—Registered November 4th. Capital, £2,000 in £1 shares. To carry on the business indicated by the title. Minimum cash subscription 7 shares. The first directors are: A. G. Collis, 25, New Road, Brentwood; J. Bradford, Ivybank, Leytonstone, E.; D. Cornish, Mount Lodge, Hutton Mount; H. F. Wood, Oaklands, Hutton Mount. Secretary: J. W. Vincent. Registered office: 53, New Broad Street, E.C.2.

Newcastle & Sunderland Oxy-Electric Welding & Metallurgical Co., Ltd. (171,250).—Private company. Registered November 5th. Capital £5,000 in £1 shares. To carry on the business of welders and artificers in metal and all kinds of engineering works and metallurgical and other operations, &c. The subscribers (each with one share) are: J. R. Pakeman, 11, Ironmonger Lane, E.C., solicitor; H. M. Cordrey, 11, Ironmonger Lane, E.C., solicitor's managing clerk. The first directors are to be appointed by the subscribers. Solicitors: Pakeman, Son & Read, 11, Ironmonger Lane, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Yale Electric Power Co., Ltd. (60,493).—Return dated August 12th, 1920. Capital, £20,000 in 3,300 preferred shares of £1 each and 668 ordinary shares of £25 each; 300 preferred and 668 ordinary shares taken up; £15,300 paid, £1,700 considered as paid. Mortgages and charges, £6,000.

English Electric Co., Ltd.—Charge on shares in various companies and certain lands and buildings, &c., dated October 13th, 1920, supplemental to indenture dated December 12th, 1919, securing £250,000. Holders: Lloyds Bank, Ltd.

Monometer Manufacturing Co. (1918), Ltd.—Satisfaction in full on February 20th, 1920, of debentures dated August 12th, 1918, securing £20,000.

CITY NOTES.

Drake and Gorham, Ltd.

At the annual meeting of this company, on November 4th, the chairman, Mr. Bernard Drake, said the profit of £23,017 was about £4,000 above the average for the three years 1917 to 1919, and this was after reserving £1,819 for further depreciation of Stock Exchange investments, and about £900 for interest on bank overdraft. The transfer of the wholesale department to a separate company has involved a division of the items of goodwill, stock, &c. Thus the item of goodwill which last year was written down to £44,000 now appears as £26,244 3s. 5d., and the item of investments is increased from £20,853 19s. 9d. to £86,518 11s. 3d. The shares of the sub-company are taken at par, which is well justified by the return made to the parent company on the investment. The stock which last year stood at £39,355 appears this year at £11,606, representing the portion appertaining to the company. The turnover has increased enormously, and the orders in hand on July 1st, 1920, gave every indication of a continued expansion of business. Further working capital being necessary, the directors are making an issue of £50,000 7-year notes, bearing interest at 10 per cent., and redeemable at 105. As these notes will yield nearly 10½ per cent. to redemption, and are well covered both as regard profits and assets, they should be readily taken up. The large power station at Widnes, with an output of 10,000 kilowatts, and provision for extensions, is now completed, and contracts are in hand for the electrification of mines, cotton mills, and the driving of machinery of various kinds by electric power.

Societe Suisse pour l'Industrie Electrique at Glarus.

The Société Suisse pour l'Industrie Electrique at Glarus, which has suffered heavy losses owing to the fall in the Continental exchanges, is about to reorganise its capital account. This company, which has a share capital of 20,000,000 fr. (£800,000 at the par of exchange), and owns 60,000,000 fr. in debentures, is holding shares of, and has made advances on current account to, various electric enterprises in Russia, Austria, France, Germany, Spain, and especially in Italy. Before the war the société was a flourishing concern, and the directors explain that, on the basis of pre-war prices and exchanges, there would have remained a surplus of 34,987,379 fr. after payment of all the creditors, debentures, and shares. The total value of the assets would have amounted then to 131,900,117 fr., but on the basis of the average prices for October the value is only 53,183,055 fr., and with creditors, debentures, and shares representing together a total of 96,912,737 fr., there is a total loss of 43,729,682 fr. Of this loss, however, an amount of 25,493,548 fr. is covered through exchange guarantee contracts. There remains thus an uncovered balance of about 18,236,133 fr. As the earnings are not sufficient to pay the debenture interest, a reconstruction of the undertaking is necessary. Liquidation being not advisable in view of the exchange contracts, which will only fall due in 1940, the board proposes to transform the whole of the debentures into 6 per cent. cumulative preference shares, to be repaid at 110 per cent., and to write down the face value of the shares from 500 fr. to 100 fr. This would produce an amount of 16,000,000 fr. to be set off against loss, while the remaining balance would be written off through the profit and loss account. The directors hope, if the exchanges should not deteriorate further, to be able to distribute a small dividend on the preference shares for the business year 1921.

Stock Exchange Notices.—The undermentioned have been ordered to be officially quoted:—

London & Suburban Traction Co.—Four ordinary shares of £1 each, fully paid, Nos. 1,846,078 to 1,846,081; and four 5 per cent. cumulative preference shares of £1 each, fully paid, Nos. 1,603,435 to 1,603,438.

The Committee has specially allowed dealings in the following under temporary regulation 4 (3):—

Erinoid.—260,000 shares of 5s. each, fully paid, Nos. 740,001 to 1,000,000.

Belgian Electric Cable & Rubber Works.—The Belgian Electric Cable & Rubber Works, Brussels, which was formed in September, 1919, with a capital of 3,500,000 fr., is at present inviting applications for 2,530 shares of 500 fr. each at a premium of 100 fr. per share. According to the prospectus the company owns two factories. One is in the Rue Bollinckx, Anderlecht, near Brussels, where employment is given to about 200 hands engaged on the production of electric wires and cables. The works have an area of 4,200 sq. metres, but large extensions are in hand. The other factory is at Menin; it was badly damaged during the war, but the work of reconstruction is well in hand, and it is expected that the manufacture of industrial rubber goods will be commenced there early next year. When the two factories are in full working order it is anticipated that the annual output of the company will attain a total of 12,000,000 fr.

A Swedish Company.—The report of the directors of the Elektrisk A. B. Chr. Bergh for the year ended on May 31st, 1920, shows a loss of 1,130,000 kr., as compared with net profits of 619,000 kr. in the preceding year. During the year a scheme of reorganisation was undertaken with the object of accommodating the company to the change in circumstances, and the result was the discontinuance of the less remunerative departments and branches and a reduction in the staff. The directors recommended that the loss should be met by the appropriation of the whole of the disposition and building funds and the transfer of 928,000 kr. from the reserve fund, and the recent general meeting approved the adoption of these measures.

Amazon Telegraph Co., Ltd.—The report for the year ended June 30th, 1920, shows a gross revenue of £85,130, and working expenses £43,239. After providing £4,163 for income tax, £6,548 for depreciation of investments, £10,981 for debenture interest, and £11,965 for sinking fund, and the payment of a dividend of 4½ per cent., less tax, on the share capital, there is a balance of £7,131 to be carried forward, subject to corporation profits tax. Nothing is transferred to the reserve this year owing to the heavy depreciation in value of the company's investments.

New Issues.—*Westinghouse Brake Co., Ltd.*, is making an issue of £350,000 8 per cent. first mortgage debentures at 95 per cent. The company as now constituted is a combination of the Westinghouse Brake Co. and the Consolidated Signal Co., and the name of the undertaking will be altered to the Westinghouse Brake & Saxby Signal Co., Ltd.

United Electric Tramways Co., of Caracas.—The report for the year ended June 30th, 1920, states that after making due provision for excess and corporation profits taxes the net revenue amounted to £16,346, which, with the balance brought forward, shows a disposable balance of £21,467. A dividend of 8 per cent. is recommended, carrying forward £7,867.

Singapore Electric Tramways Co., Ltd.—The directors report that after providing £23,523 for maintenance and repairs, £14,076 for depreciation, and £615 for royalty to the Municipality of Singapore on the tramway profits for 1918, the accounts for the year ended December 31st, 1919, show a loss of £6,537, which increases the debit balance to be carried forward to £11,943.

Siemens Brothers & Co.—Dividend of 5 per cent. (1s. per share), free of tax, for the half-year ended June 30th, payable November 30th.

Aster Engineering Co., Ltd.—Interim dividend at the rate of 8 per cent. per annum on the preference shares, and at the rate of 10 per cent. per annum on the ordinarys.

National Telewriter Co., Ltd.—The accounts for the year ended June 30th, 1920, show a balance to the credit of profit and loss account of £1,067.

Indian Electric Supply & Traction.—Interim dividend at the rate of 6 per cent. per annum, less tax, on the ordinary shares for the half-year.

Anglo-Portuguese Telephone Co., Ltd.—Interim dividend of 3 per cent., less tax.

STOCKS AND SHARES.

Tuesday Evening.

Resumption of work by the coal miners had to take a subordinate position to other matters of greater public interest. Mr. Greenwood's case, for instance, has made more impression than the result of the coal dispute, and there are various items of equal importance to detract from interest in business affairs. This may have something to do with the quietude which has befallen Stock Exchange markets. Members of the House declare they have rarely seen business so uninteresting, although from the point of view of quantity, some firms say they are snowed under with small orders, the execution of which hardly pays.

Markets seem to be none too happy about the monetary outlook, but whatever pessimism there may be in this direction is answered very effectively by the way in which British Government stocks continue to rise. Such an influence naturally counts with all fixed-interest stocks, and in spite of increasing competition, the best class securities command noticeable attention from the genuine investor.

Further rises in dollar stocks are amongst the features of the week. General Electric of New York fives are 3 up at 126. Canadian General Electric Common rallied to 120, and the preferred to 115½. Rio Tramways firsts at par are 4 higher, and Sao Paulo firsts have risen to 97. Mississippi River Power preferred at 76 is 3 to the good. Electric Development of Ontario 5 per cents have improved 1½ to 117½. Such movements as these are made simply in order to bring the quotations into their proper relation with the rate of New York exchange, and they may be accompanied by scarcely any actual business. As prices advance, it naturally becomes more difficult for the remaining holders to decline such figures, but it is quite feasible for quotations to move 5 to 15 points without five hundred dollars' worth of stock being dealt in.

The railway market has halted in its upward march, and amongst the steam stocks, a general easing-off of quotations occurred. Underground Electric "A" shares are a little lower at 7s., but Districts improved to 18½, a rise of the fraction. The demand for pre-ordinary stocks continues, and with comparatively little floating supply available, prices in this market steadily creep up. The tendency of money nowadays is to seek safety in sound securities rather than to adventure into more speculative directions, and for this reason, the pre-ordinary stocks of the Home Railway companies, many of which stand at low levels, are being examined with a view to possible appreciation in price in years to come. Underground Income Bonds are unchanged at 70½. It is a little interesting to notice in connection with transport matters that one of the big shipping lines in the United States has just adopted electrical propulsion for half-a-dozen of its ships, and the result of the experiment will be watched with a good deal of attention on both sides of the Atlantic.

The possibility of the Income Tax going up next spring, of which mention was made here last week, has further improved the quotations of cable stocks and shares. Easterns have risen to 161¼, Globe ordinary and China shares to 15. Moreover, there is very little stock to be obtained. It may possibly pay the prospective buyer of these issues to ask whether he can obtain the new shares of the four leading Eastern companies at a rate relatively cheaper than those current for the old issues. The nominal prices are about £9 for the £5 paid new Eastern Extension, Western and Globe shares. Eastern Telegraph new, 10s. paid, stand at 18s. 6d. Making necessary allowances for the difference in dividend payments on old and new shares, the latter come out the more cheaply. Apart from Eastern stocks, there is not much doing, but Cuba Submarines rose ¾ to 7, on consideration of the high yield afforded at the present price. Even at 7, the return comes to 10 per cent. on the money, and dividends hitherto have been paid free of tax, which makes this equal to about 14 per cent., allowing for 6s. in the £. Marconis, after being 3, reacted a little. The Canadian Marconi Company announces that a meeting is to be held on November 23rd in Montreal to consider resolutions to increase the capital from 2½ million dollars to 7½ million dollars by the addition of 1½ million shares of 2½ dollars each. This has caused the existing Canadian Marconis to ease off a little to 8s. 9d.

The slightly harder tone which developed in home electricity shares is maintained, and County of London hardened to 7¼, Chelseas to 3½. Westminsters hold their rise at 5½. Business, however, is exceedingly quiet and interest at a low ebb. Amongst the manufacturing shares, Edisons recovered to 17s. 6d. Great interest is taken in what the dividend is likely to be. It may be recalled that the interim dividend was postponed last May, and this came as a severe disappointment. For 1919, the company paid 10 per cent., and in the absence of an interim dividend, it is natural that there should be a little misgiving as to whether this rate can be maintained in respect of 1920, although in the Stock Exchange, rumour says that the company will be able to do it. It should not be more than a week or two, however, before the question is set at rest by an official announcement.

General Electrics are better at 1⅛, and the "B" preference stiffened to 20s. Telegraph Constructions rose to 21. In their case it is pointed out that the recent heavy increases of capital by the Eastern group of cable companies should help the construction undertakings to a noticeable extent, inasmuch as the latter are likely to benefit by the expenditure of part of the money. Electric Constructions keep steady at 18s. 9d., and Henley's maintain their improvement at 33s. 9d., while Siemens are firm at 25s. Callender's "B" preference are 19s. 6d. buyers, with no shares offering. Amongst engineering shares, Babcock & Wilcox keep good at 2½, on the increase in the interim dividend recently made, but the conclusion of the coal strike has passed almost without effect. To explain the comparative indifference with which the public are treating the markets for stocks and shares affected by coal, it is pointed out that something of a rise occurred in advance of work being resumed, but the observer knows well enough that people are not buying industrials just now, seeking rather investment securities, or else putting money into the high-yielding debentures. Notes and similar issues that are being made with freedom. It is said, moreover, that there are many other new issues likely to be put on the market before Christmas.

Mexicans are moving a little irregularly so far as the utilities are concerned, but Mexican Government stocks are decidedly better, on the statements from Washington that the way is now clear for Mexico to obtain the long-talked-of loan from the United States. When once this becomes an accomplished fact, Mexicans are likely to go ahead, and indeed all the news from the country promises favourably enough. British Columbia Electric stocks have again been rising, the preferred and deferred gaining 2, the preference 1½, and the 4½ per cent. debenture stock 4 points. As already mentioned, the reason for the advance lies in the capital progress which the company is making in its traffics, and the prospect thus held out for better dividends. Anglo-Argentine Tramways 5 per cent. Debenture is better at 62½, and Brazil Tractions rose to 45. Apart from these, the main movements in the foreign list are concerned with rises amongst dollar stocks as indicated above. Calcutta Electric Supply drooped to 5½ on declaration of a dividend at the rate of 8 per cent., and Calcutta Trams fell to 6½ in sympathy.

Rubber shares are dull and depressed, on the price of the raw material falling to 1s. 1d. per lb., at which there can be little or no profit for the great majority of producing concerns. In some cases, however, the boards of rubber companies have sold forward at higher levels, and this serves to temper the flatness of the list as a whole, although, of course, it is only a temporary factor. Armament shares are unsteady, Vickers and Armstrongs both going back after their sharp recoveries from the lowest touched. The recently issued Notes by the Explosives Trades Company were well taken by the public, and a premium of ¼ per cent. is quoted.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1918.	Dividend 1919.	Price Nov. 9, 1920.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	8	13	6	—	£10 0 0
Charing Cross Ordinary	4	7	8½	—	10 15 6
do. do. do. 4½ Pref.	4½	4½	9¾	—	8 8 8
Chelsea	3	4	9¼	+ ½	6 9 0
City of London	8	10	11	—	8 17 10
do. do. 6 per cent. Pref.	6	6	17/6	—	6 17 2
County of London	7	9	7¼	+ ¼	10 13 4
do. do. 6 per cent. Pref.	6	6	8½	—	7 7 8
Kensington Ordinary	6	7	8¼	—	9 0 6
London Electric	Nil	1½	1	—	7 10 0
do. do. 6 per cent. Pref.	6	6	8	—	10 0 0
Metropolitan	6	6	8¾	—	10 5 8
do. 4½ per cent. Pref.	4½	4½	9½	— ¼	8 0 0
St. James' and Pall Mall	10	12	6½	—	9 4 8
South London	6	6	8¾	—	9 12 0
South Metropolitan Pref.	7	7	10 3	—	8 12 8
Westminster Ordinary	8	10	7½	—	9 5 8
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	7⅞ xd	—	7 14 10
do. Def.	33/6	1½	17	—	8 16 6
Chile Telephone	6	6	6½	—	*5 9 1
Cuba Sub. Ord.	7	7	7	+ ¼	*10 0 0
Eastern Extension	8	10	14½	+ ½	*6 13 4
Eastern Tel. Ord.	8	10	15¼	+2	*6 13 0
Globe Tel. and T. Ord.	8	10	15	+ ½	*6 13 4
do. do. Pref.	6	6	8½	+ ¼	6 17 2
Great Northern Tel.	23	23	20½	—	10 14 6
Indo-European	13	13	60 xd	—	8 6 8
Marconi	25	25	2⅛	—	8 10 0
Oriental Telephone Ord.	10	15	2¼	—	*4 18 4
United R. Plate Tel.	8	8	6½	—	*6 10 8
West India and Panama	1/8	Nil	¼	—	Nil
Western Telegraph	8	12	15	—	*6 13 4
Home Rails.					
Central London Ord. Assented	4	4	6¾	—	9 4 0
Metropolitan	1	1½	21½	—	5 16 8
do. District	Nil	Nil	18½	+ ½	Nil
Underground Electric Ordinary	Nil	Nil	2⅜	—	Nil
do. do. "A"	Nil	Nil	7/-	- 6d.	Nil
do. do. Income	3	4	70½	—	—
Foreign Trams, &c.					
Anglo-Arg. Trams First Pref.	Nil	Nil	6	—	9 3 4
do. do. 2nd Pref.	Nil	Nil	3½	—	Nil
do. do. 5 Deb.	5	5	62½	+2	8 0 0
Brazil Tractions	Nil	Nil	45	+ 1	Nil
Bombay Electric Pref.	8	8	11	—	4 16 8
British Columbia Elec. Rly. Pfor.	5	5	47½	+1½	5 13 10
do. do. Preferrred	3½	5	57½	+2	*5 1 9
do. do. Deferred	Nil	5	18½	+2	*5 19 8
do. do. Deb.	4½	4½	57½	+4	7 7 10
Mexico Trams 5 per cent. Bonds	Nil	Nil	4½	—	Nil
do. 6 per cent. Bonds	Nil	Nil	22	—	Nil
Mexican Light Common	Nil	Nil	15	—	Nil
do. Pref.	Nil	Nil	31	—	Nil
do. 1st Bonds	Nil	Nil	64½	+3	Nil
Manufacturing Companies.					
Babcock & Wilcox	15	15	3½	—	*6 0 0
British Aluminium Ord.	10	10	1	—	10 0 0
British Insulated Ord.	12½	15	18	—	9 4 8
Callenders	25	15	1½	—	10 0 0
" 6½ Pref.	6½	6½	18/0	—	6 15 8
Castner-Kellner	20	17	3	—	5 18 4
Crompton Ord.	10	15	17/6	—	11 8 6
Edison-Swan, "A"	10	10	17/6	- 6d.	11 8 6
do. do. 5 per cent. Deb.	5	5	76½	—	6 12 6
Electric Construction	10	10	18/0	—	10 13 4
Gen. Elec. Pref.	5½	6½	18/6	—	7 0 5
do. Ord.	18	10	18	+ ⅛	*7 5 6
Henley	25	15	1½	—	9 4 8
do. 4½ Pref.	4½	4½	3½	—	7 4 0
India-Rubber	10	10	1½	—	*8 0 0
Met.-Vickers Pref.	—	8	4	—	8 0 0
Siemens Ord.	10	10	25/-	—	*8 0 0
Telegraph Con.	20	20	21	+1	*5 14 3

* Dividends paid free of Income Tax.

STREET LIGHTING.—II.

By HAYDN T. HARRISON.

That the question of street lighting is rapidly becoming of primary importance is evidenced by the report of the committee which lately dealt with the question of motor-car headlights. That powerful headlights are necessary when travelling at the present-day speed on unlighted roads was admitted, but it was generally agreed that such headlights should be turned off when the light from the street lamps produced sufficient illumination to allow a vehicle to travel with safety to the public. It is interesting to note that in the discussion on this subject at the Illuminating Engineering Society, Mr. J. W. T. Walsh suggested, as the result of the National Physical Laboratory's experiments, that 0.1 foot-candle was required to produce the degree of visibility necessary 200 ft. in front of the car.

The proposed "standard clauses for inclusion in a specification of street lighting," as published by Mr. A. P. Trotter in his paper read before the Illuminating Engineering Society, in April, 1913, which were recommended by the Joint Committee (consisting of representatives of the Institution of Electrical Engineers, Institution of Gas Engineers, the Municipal and County Engineers, and the Illuminating Engineering Society), formed on the suggestion of Mr. C. P. Sparks after the discussion of the writer's paper read before the Institution of Electrical Engineers in 1910, put forward the following valuable recommendations, based on actual tests made at that time, namely, that streets should be classified as follows:—

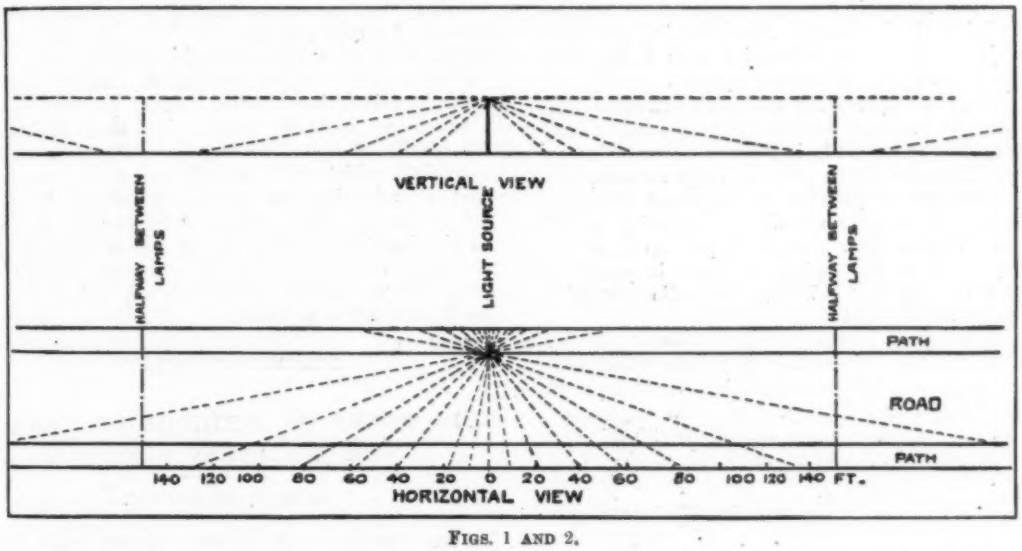
Table III.

Class A.	—Having a minimum horizontal illumination of 0.1 foot-candle.
Class B.	—Having a minimum horizontal illumination of 0.025 foot-candle.
Class C.	—Having a minimum horizontal illumination of 0.04 foot-candle.
Class D.	—Having a minimum horizontal illumination of 0.06 foot-candle.
Class. E.	—Having a minimum horizontal illumination of 0.01 foot-candle.

This table, taken in conjunction with the discussion on motor-car headlights, would indicate that in order to allow of powerful headlights being turned off, the streets must be lighted up to the highest standard mentioned.

A reference to Mr. Trotter's paper will show that only the best illuminated streets in London, such as Cheapside, Whitehall, Regent Street, &c., reached the standard at that time, and with few exceptions this is still the case both in London and in important provincial towns such as Manchester and Birmingham, &c. This being the case, it is obvious that either the standard of street illumination must be raised, or the traffic requirements must be held back in order to ensure the safety of the public.

To raise sufficiently the standard of street illumination would, under circumstances which existed ten years back, have then meant a heavy increase of rates; to do so to-day only requires the expenditure of a relatively small sum, due to the great advance which has taken place in knowledge of the use of illuminating appliances. In order to save considerable expenditure, it is often advisable that the existing positions of street lamps should remain the same; it is, therefore, necessary to ascertain the power which such lamps should have, to give the desired results—which for the sake of argument we will take as a minimum of 0.1 foot-candle horizontal illumination on the road, or to conform with the recommendation of the Joint Committee on a horizontal plane 3 ft. 3 in. above the road level.



Figs. 1 and 2.

These figures are given in Table IV for lamps placed at various distances and heights, the latter being an important factor when dealing with horizontal illumination.

Table IV.

Distance between lamps. ft.	Height. 12 ft. C.P.	17 ft. C.P.	24 ft. C.P.	30 ft. C.P.
100 ...	750	580	383	340
120 ...	1,280	850	617	530
140 ...	2,010	1,320	840	787
160 ...	3,000	1,950	1,360	1,123
180 ...	4,240	2,750	1,900	1,550
200 ...	5,800	3,750	2,570	2,970
220 ...	7,700	4,960	3,380	2,710
240 ...	10,000	6,420	4,360	3,480
270 ...	14,200	9,080	6,150	4,880
300 ...	32,000	12,450	8,380	6,620

A glance at the above table indicates the great importance of keeping the light sources as high as possible, which also has the advantage of permitting the use of powerful units, as they are out of the line of sight, but such an arrangement has hitherto often proved impracticable on account of both primary expense and increased cost of the more powerful units.

The improved illumination demanded by modern traffic conditions would appear to eliminate the consideration of lamps at a height of less than 17 ft., as the use of units of more than 1,000 C.P. at a lower height than this would lead to unsatisfactory results due to glare.

A height of not less than 24 ft. should therefore be aimed at.

TABLE V.

At 120 ft. apart	617 c.p.	or	27,000 c.p.	to the mile.	
180 „ „	1,900 „	„	57,000 „	„	
240 „ „	4,360 „	„	96,000 „	„	
300 „ „	8,380 „	„	110,000 „	„	

Table V gives the necessary c.p. to obtain the minimum horizontal illumination of 0.1 foot-candle, and also the total c.p. necessary per mile of street for different spacings.

It will be noted that when the lamps are spaced at 300 ft., four times the total c.p. is needed to equal that at 120 ft., the actual c.p. of each lamp being 13.5 times as much, despite the fact that the area and minimum degree of illumination are the same. This is due to the street being a narrow elongated area; the lamps actually illuminate a very large area beyond the limits of the street or road, unless some special device is adopted to prevent this waste of luminous energy.

In order to realise the importance of such a device, it is necessary to remember that luminous energy is distributed from light sources in all directions, but that the only useful energy is that which reaches the objects which it is desired to see. For this reason the energy in the upper hemisphere is usually diverted into the lower hemisphere by means of reflectors or prisms, which preferably concentrate it into the angles from 10 and 20 degrees below the horizontal, thus reaching the more distant objects, which are otherwise very feebly illuminated due to the law of inverse squares.

Such reflectors and prismatic globes are available, and will increase the intensity from twice to two and a half times the mean value. This is a great advance in the right direction, but still represents a large consumption of gas or electricity to produce the degree of illumination demanded by modern conditions, as owing to the circular distribution of the rays 75 per cent. of the increased power near the horizontal angles is wasted in illuminating the adjacent buildings, or radiates outside the area to be illuminated.

Reference to figs. 1 and 2 will show how at 150 ft., the distance halfway between the lights, the whole area of a street up to a height of 25 ft. is covered by a 10 deg. vertical angle and 20 deg. horizontal angle, and that more than half the distant area to be illuminated is covered by 30 deg. A solid angle of 30 deg. only represents .213/12.56 part of the total spherical flux; thus it follows that street lighting can be carried out much more economically by directing the luminous flux, than by allowing it to be distributed equally in all directions as is the case with many forms of illuminants, or by increasing the radial distribution over certain vertical angles as is done by the present improved street lighting devices. Apparatus for directing the luminous flux to the distant parts of a street or road have been devised by several people, but they have all hitherto proved impracticable on account of the fact that they interfere with the lower hemispherical distribution, thus reducing their efficiency and making it essential to devise special means of illumination near the post.

The writer has devised a means by which only the upper hemispherical luminous energy is directed to the distant area of the street, the lower hemispherical distribution remaining unaltered.

With this apparatus the luminous intensity in the required direction is ten times that of the original source; this is not as high as it theoretically could be made, but it is the average result in practice without any special adjustments, and including all losses due to the absorption of protecting lanterns, dirt, &c. The illumination of the street is purposely allowed to increase near the light sources, as it has been found in practice that too even an illumination is a disadvantage, as it reduces contrast of light and shade.

A long street lighted in this way has now been in operation several months in order to test the public opinion and that of motorists and those connected with fast-moving traffic; the criticisms have been universally favourable. It is, therefore, interesting to compare the costs of lighting by this and other means.

The road was originally lighted by means of 550-watt flame arc lamps erected 22 ft. from the ground at intervals varying from 240 to 300 ft.; the result under those conditions was brilliant illumination near the lamps, which diminished to 0.005 foot-candle half-way between them. With the new directive fittings the minimum is now 0.05 foot-candle, or ten times more than that previously maintained; this is being done by the use of gasfilled lamps giving 300 to 350 c.p. at the declared pressure of the supply, as they are purposely underrun in order to obtain a higher average life, with the result that the consumption of electrical energy amounts to 6 b.t.u. per hour per mile.

Taking all-night lighting (4,000 hours per year), and the price per unit at 3d. (which is in excess of that generally charged at the present date), the total cost for electrical energy per mile of street lighting would only be £300 for this high standard of street lighting. The cost of lamp renewals, cleaning, &c., with an average life of 800 hours for the lamps, amounts to less than £100 per mile of street per annum, with the result that the new directive street lighting allows of the illuminating of streets up to a standard ten times higher than that previously obtained at a cost not exceeding the pre-war figures.

Such a result would be incredible, as it represents an advance of 3,000 per cent. efficiency (if such a figure may be used) since pre-war days; but this only emphasises the remarks of Mr. Preston S. Millar referred to earlier in this article, namely, that if proper advantage is taken of modern lamps in conjunction with scientifically designed fittings for them, results can be obtained which will not only bring the standard of street illumination up to that demanded by present road traffic, but which will do so (including the interest and sinking fund charges on the expenditure of capital necessary), at a cost which is lower than that paid annually for the present inefficient, expensive, and what should be obsolete methods.

SOME NOTES ON METHODS OF CHARGING FOR WATTLESS CURRENT.

By G. W. STUBBINGS.

The recent articles on the subject of power factor, from the pen of Mr. Turnbull, and the discussion arising therefrom, seem largely to turn on the matter of the most equitable basis on which the price of electrical energy can be made to vary with the power factor of the demand. The vexed question of wattless current has come in for its due share of attention, and one cannot but think that a notion which is, after all, a mathematical fiction, is hardly one to be put before the uninstructed consumer. The vital feature of a load of low power factor is that it draws more current from the mains than does the same load at a power factor of unity, and that for the low-power-factor load the supply authority, in addition to giving the required number of kilowatts, has also to furnish an additional number of k.v.a. It is the arithmetical, and not the vectorial, difference between the k.v.a. and the kw. that is the matter of real importance. Consider, for instance, a load of 10 kw., at ·95 power factor, and 400 volts. The current in these circumstances will be 26·4 amperes, which is 1·4 amperes in excess of that required for the same load at unity power factor. The wattless component of this current is, however, no less than 7·8 amperes.

Mr. Dorey has rightly pointed out that the most rational method of charging for energy on a.c. systems is on the basis of a fixed charge per quarter per k.v.a. of maximum demand, plus a fixed rate per unit. This tariff penalises low power factor on a basis as equitable as can be devised, and also takes load factor into account. The alternative method of a variable rate per unit, due to Dr. Arno, has also been referred to by Mr. Dorey, but the basis of this

method, and its relation to the notion of "extra current" mentioned above, may be of interest, as they are not at once apparent.

Dr. Arno's system is to charge a fixed sum per complex unit, the number of such complex units being a certain fraction, say, $1/n$ of the K.V.A.-hours, plus a fraction equal to $(1 - 1/n)$ of the energy consumption in units.

If w be the watts in the circuit, and cos ϕ be the power factor, the rate of charging is—

$$(n - 1)\ w/n + 1/n\ .\ w/\cos\phi$$
$$= w + 1/n\ (w/\cos\phi - w).$$

The quantity $(w/\cos\phi - w)$ in this expression is plainly equal to the excess volt-amperes over those actually necessary to supply the load. The excess K.V.A. carry no power, and are, therefore, in a sense "wattless," although, of course, they are not to be confounded with the wattless currents of the text books. The excess K.V.A. cost the undertaking nothing for coal, and use none of its boiler plant, but requiring, as they do, alternator, cable, and transformer capacity, they cannot be supplied for nothing. If a definite fraction $1/n$ of the normal price per unit be assessed by the undertaking as the price of an "excess" K.V.A.-hour, the rate of charging for the excess K.V.A. is—

$$1/n\ (w/\cos\phi - w),$$

and the overall rate of charging for energy supplied—

$$w + 1/n\ (w/\cos\phi - w).$$

This expression represents Dr. Arno's method of charging. Mr. Dorey gave a specific example of this method: a charge based on two-thirds of the energy consumption, plus one-third of the K.V.A.-hours. The factor $1/n$ in this case is $\frac{1}{3}$, and this tariff is fixed on the basis that the cost of a K.V.A.-hour at zero power factor is $\frac{1}{3}$ of the cost of a unit.

An adaptation of Dr. Arno's system has been adopted by many undertakings in the shape of a tariff specifying a variable price per unit, this price depending upon the power factor, the variation being fixed by a schedule. The use of a schedule is objectionable in that the price per unit changes suddenly, and if the average power factor as calculated happens to be just under one of the changing points, the method of determining this very complex quantity is always liable to be challenged. A system used by the American Gas and Electricity Co., recently described in the *Electrical World*, fixes a definite rate per unit, this rate being based on an average power factor of 0·85. The chargeable consumption is multiplied by a factor depending upon the power factor, the multiplier being fixed by a schedule, and being less than unity for power factors over 0·85. A curve showing the variation of the multiplying factor with the power factor is shown in fig. 1, and an examination of the curve shows that it is based on the cost of a wattless K.V.A.-hour being $\frac{1}{3}$ the cost of a unit. A curve showing the multiplying factor on the basis of an average power factor of 0·8, using Dr. Arno's method, is given in fig. 2. To draw this curve, the differences between the K.V.A. at each power factor and those at a power factor of 0·8 have been calculated. When this difference is negative, the standard charge will be reduced. Fig. 3 is a curve giving the multiplying factor plotted against values of tan ϕ as given by the ratio of the consumptions registered by a wattless component and an energy meter.

Meters specially adjusted to register K.V.A.-hours or complex units are difficult to test, and are only theoretically accurate over a limited range of power factors. On the other hand, wattless component meters are simple in theory, accurate at all power factors, and can be easily tested with up-to-date equipment. The latter meters would, therefore, seem to be more suitable for use with a tariff specifying a variable rate per unit, and the value of tan ϕ, as given by the ratio of the wattless component and energy meter readings would afford a simple basis on which to assign the rate per unit to be charged. The average value of tan ϕ as so obtained will differ from the time average of the values of this quantity at any instant, but will approximate to a weighted mean value, one obviously more suited to the fixing of a charge per unit than a time average value. The writer puts forward the suggestion that a curve such as fig. 3 based on Dr. Arno's method, might form part of an agreement for a power supply, this method seeming preferable to the series of jumps necessary with a schedule. The multiplying factor for any ratio of the two meter readings is given by the expression—

$$m = 1 + 1/n\ (\surd\ (l^2 + 1) - 1/\cos a),$$

cos a being the power factor for which m is unity, and l being the ratio of the meter readings. If cos $a = 0{\cdot}8$ and $1/n = \frac{1}{3}$, the expression becomes—

$$m = 0{\cdot}588 + \tfrac{1}{3}\ \surd(l^2 + 1).$$

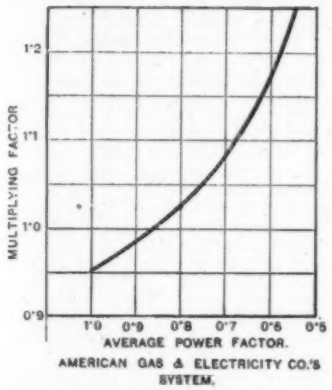


Fig. 1.

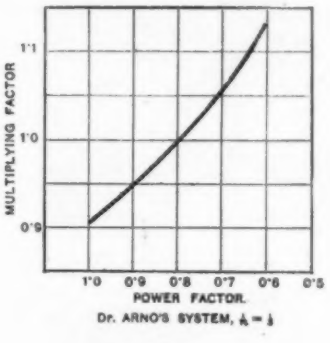


Fig. 2.

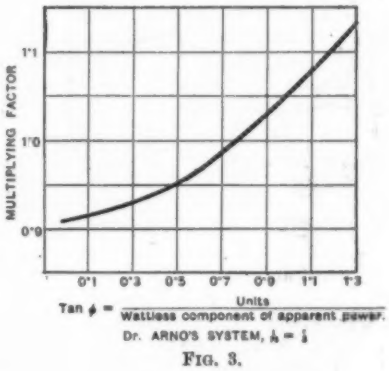


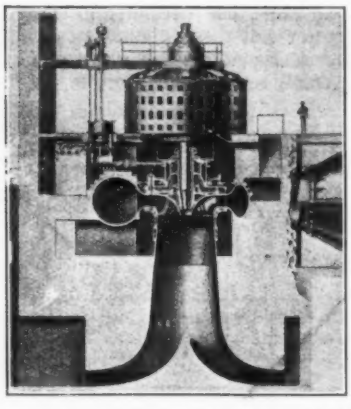
Fig. 3.

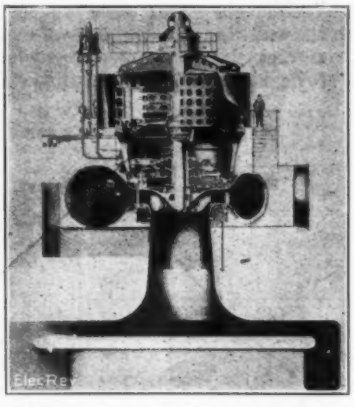
Labour Act in Holland.—According to the *Gazette de Hollande*, the new Labour Act which came into force in Holland on October 24th provides for an eight-hour day and a 45-hour week in all factories and workshops, but does not apply to offices, to agriculture, horticulture, forestry, or mining, while the stone industry and dock labour will be the subjects of special legislation. Sunday work is forbidden for youths and women, and in the case of men may be allowed by special arrangement; Saturday work after 1 p.m. is governed by the same conditions. The day's work must not begin before 7 a.m. or finish after 6 p.m., a special permit being required for overtime and for night work. In exceptional circumstances the chief inspector may allow an extension of work up to a maximum of eleven hours a day in the case of men and up to ten hours in the case of women and youths over 16, but the provisions of the Act limiting the number of hours do not apply to managers or sub-managers, to foremen, or overseers in charge of the hands. Child labour under 14 years of age is absolutely forbidden.—*Economic Review.*

High-Voltage Transmission.—For transmitting energy from its new Pit river hydroelectric development, the Pacific Gas & Electric Co., San Francisco, will use 220,000 as the transmission voltage. Energy will be transformed at the station to this voltage by 16,667-K.V.A., 127,000-volt, single-phase, water-cooled, outdoor type, Westinghouse transformers connected in star to obtain 220,000 volts. There will be two banks of three of these transformers making a total rating of 100,000 K.V.A. An additional emergency transformer will also be installed to be used on either bank.—*Electrical Review* (Chicago).

LARGE WATER TURBINES.

The 100,000-h.p. extension to the plant in the No. 3 station of the Niagara Falls Power Co., which has been considered from the general engineering point of view in recent issues of the *Electrical World*, embraces what are claimed to be the most powerful hydraulic turbines ever built. Two of these 37,500-h.p. machines, with Westinghouse generators, were furnished by the I. P. Morris department of the William Cramp & Sons' Ship and Engine Building Co., and the third set by the Allis-Chalmers Manufacturing Co. to the same general specifications. The contracts were not placed on a basis of competitive bids, but general dimensions, external appearance, paralleling characteristics, and general excellence were specified instead.





Figs. 1 and 2.—Two new 37,500-h.p. Hydro-electric Generators.

Figs. 3 and 4.—Runner Before and After Assembly.

Brief particulars of the machines were given in concluding a series of four articles in our issue of September 19th, 1919, dealing with water-power developments in Canada, but we are now able to abstract from the *Electrical World* further information.

Since the design of the entire Allis-Chalmers hydro-electric set was under the control of a single group of engineers, it was possible to consider the structure as a homogeneous unit. Its most striking features are the form of casing, governor, interconnecting barrel, brake support, and draught tube.

The casing is built up of a multiplicity of conical sections of steel plate of gradually-reducing cross-sectional area around the turbine. The plates are riveted to the flanges of a cast-steel speed ring, which forms an integral part of the casing and the foundation of the turbine parts.

Water from the casing to the runner is controlled by means of 20 cast-steel guide vanes; each vane is operated by a lever through a link attached to the shifting ring on the outside of the turbine, and is held in position by two thrust bearings, one supporting the weight, and the other resisting the upward hydraulic thrust when in operation. The thrust bearings hold the guide vane in a central position between the distributer plates; consequently there is no wear between the ends of the vanes and the distributor plates. A stuffing box around each vane stem prevents water flowing through the bronze bearings supporting the vane, thus preventing grit, which would rapidly wear the main supporting journal, from being carried between the surfaces by leakage. The vane stems are attached to the shifting ring through links so proportioned that they will fail before a guide vane or its stem is strained beyond its elastic limit.

The runner is made of grey iron in one casting, and is bolted to a cast-iron hub, which is keyed to the tapered end of the turbine shaft. The turbine guide bearing consists of lignum vitæ fitted into cast-iron blocks having the end grain of the lignum vitæ towards the shaft. The bearing is 5 ft. (1.5 m.) in length, and is made in two portions for convenience in dismantling and is lubricated with water.

A peculiar feature of design is the cast-iron pit liner forming the turbine pit and transmitting the weight of the generator through the liner directly to the speed ring and through the vanes of the speed ring to the foundation. Interalignment of the generator, turbine, &c., is thus permanently ensured.

The guide vanes of the turbine are controlled by water pressure on two pistons connecting to opposite sides of the shifting ring. This arrangement keeps the governor pipes outside of the turbine chamber and enables the cover plate of the turbine to be removed without disturbing the cylinders and governor piping. The position of the stems on the guide vanes is such that the vanes will be in hydraulic balance when about one-third open. They will require considerable force to close or still further open the vanes from that point, but both forces are minimised. With a difference between the sides of the governor pistons equal to an operating pressure of 200 lb. (14 kg. per sq. cm.), and consequently by the usual method of rating governors, the governor has a capacity of 240,000 ft.-lb. (33,120 kg.-m.). The operating pressure on the cylinders is controlled by means of a four-ported piston valve in the governor stand. This valve is moved axially by varying the pressure on each end of its body by means of another four-ported piston valve, which in turn is moved by a pilot valve. With this arrangement the force exerted upon the fly-ball mechanism is not sufficient to prevent the flyballs taking up their exact position corresponding to the speed of the set. Direct-connected flyballs are used. The mechanism consists essentially of a fixed collar clamped around the main turbine shaft and a movable collar held in position and away from the shaft by four sets of ball-bearing toggle joints placed 90 deg. apart. The governor closes the turbine gates from wide open to completely shut in three seconds, and opens them from closed to wide open in four seconds. It is expected that the rise in speed with 40,000 h.p. suddenly thrown off the machine will not exceed 25 per cent.

In the turbines under discussion the diameter of the runner is so large compared with the distance from the runner to the tailwater level that it was not feasible to design the draught tube in the usual manner. Consequently a hydrocone retainer was used. The chamber has the general form which the jet of water would take upon striking the impinging surface, except that the capacity of the chamber gradually increases in the direction of flow more than is required to just close the hydrocone. The radially extending passage also affords means of regaining the useful effect of the whirl of the water as it leaves the runner at partial loads.

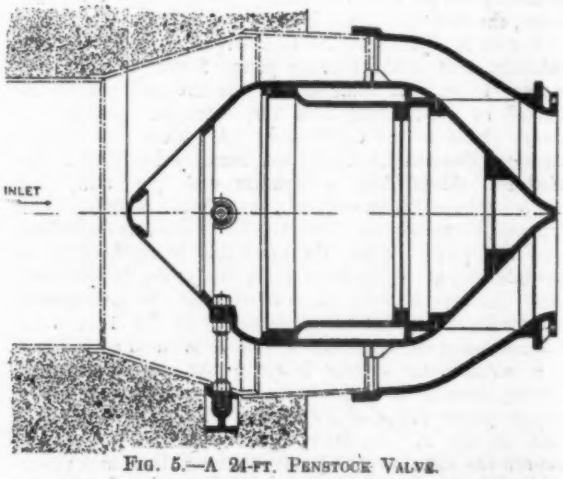


Fig. 5.—A 24-ft. Penstock Valve.

Figs. 1 and 2 show the two types of machine, also the spreading and hydrocone draught tubes, that on the right being the Allis-Chalmers set, and that on the left the Morris wheel with Westinghouse generator. The generators are rated at 32,500 K.V.A., 12,000 volts, and run at 150 R.P.M. under a 214-ft. head. Figs. 3 and 4 show the Morris runner before and after assembly, while fig. 5 is a sectional view of the largest penstock valve in the world; it is of the Johnson type, and measures 17 by 24 ft. overall, one valve being installed at the bottom of each penstock close to the entrance to the wheel casing. The balanced needle type valve has a movable plunger sliding in an internal cylinder; the plunger is of differential form providing two operating chambers, which are alternately exhausted to the air to move the plunger, the hydraulic pressure in the penstock furnishing the sole actuating force. Local or remote control can be used; the valve stroke may be set for any time up to a minimum of 30 seconds for a complete stroke in either direction, and it can also be set to close automatically in case of a serious break in the wheel casing.

The I. P. Morris vertical-shaft, single-runner, turbines have cast-iron volute casings embedded in the concrete substructure. The use of a cast-iron casing has made it possible to preserve smooth internal surface contours and to avoid abrupt changes in direction of flow. The casing is stayed across the distributer by a cast-steel speed ring, the vanes of which line up with alternate guide vanes when the latter are in the maximum efficiency position. After passing through the runner, the water enters a straight, conical, cast-iron, draught tube built in sections; the remainder of the tube is moulded in the concrete substructure.

The draught tube is of a new type, the object being to turn the water as smoothly as possible along paths of gradual curvature, and to preserve symmetry about the turbine axis to a point where the velocity has been reduced to so low a value that only a small amount of velocity head remains in the water. A gradual decrease in the velocity is maintained by varying the transverse area of the passage at all points in the tube in order to avoid eddies which might cause severe vibration of the water column in the penstock and turbine. Another advantage is the ability of the form of draught tube used to regain the energy of whirling components of velocity in the water leaving the runner. This property increases the efficiency under part and over gate conditions, and also increases the margin of power beyond the point of maximum efficiency of the turbine. Although the most valuable feature of the new form of draught tube is probably the elimination of vibration, it is also estimated that it will improve the efficiency over that which could be obtained with tubes containing elbows by from 0.3 to 0.4 per cent.

The cast-iron runners are each in one piece; their specific speed is 158 metric or 35.5 in the ft.-lb. system. At normal discharge the corrected velocity of the water leaving the runner and entering the draught tube is 21.3 ft. (6.4 m.) per second, corresponding to a velocity head of 7 ft. (2.1 m.), or 3.3 per cent. of the effective head on the turbine. The final discharge velocity from the draught tube at normal gate is approximately 5 ft. (1.5 m.) per second, corresponding to a velocity head of 0.175 per cent. of the effective head on the machine.

The cast-iron casing, although somewhat increasing the cost as compared with the use of steel plate, is superior, because it is absolutely rigid, and can be embedded to form part of the concrete substructure; it will not distort under the loads it has to transmit, and it resists corrosion. The levers, &c., of the vane-actuating mechanism are made extra strong, and renewable breaking links are provided. The operating ring is supported on a ball bearing, and is turned by two cylinders which are bolted to brackets cast on the turbine casing, thus making the entire operating mechanism self-contained with the turbine. The operating gear is lubricated on the Taylor system; a central air pressure grease gun supplying a system of piping.

To relieve thrust above and reduce leakage round the runner labyrinth seals are employed. The main shaft of the turbine has a lignum vitæ guide bearing in the turbine head cover, the bearing shell being split both horizontally and vertically to facilitate removal. Acting upon the lower face of the generator rotor are brakes consisting of a series of shoes actuated by air plungers and controlled from a cock on the hand-control stand.

To avoid running a number of governor pipes from the operating cylinders up to the gallery, with a consequent increase in the length of the fluid column and increasing its inertia, the main governor valves are separate from the governor, and placed on the level of the generator-room floor, so that they are immediately above the operating cylinders. The Taylor control system is used with fluid-operated Johnson plunger valves, by the manipulation of which the operating cylinders can be connected to either the governor or the hand-control system, all the valves for changing over being controlled by a single lever. A clutch is provided by which the governor can be put out of operation without shutting down the set.

New Ignition Magneto.—A new ignition magneto of Swiss manufacture, and known as the Scintilla, is being introduced into this country by Scintilla, Ltd., of 9, Old Queen Street, Westminster, S.W. 1.

WORKING CONDITIONS IN FACTORIES.

Report of H.M. Inspector of Factories.

We have already dealt with Mr. G. Scott Ram's portion of the annual report of the Chief Inspector of Factories and Workshops for the year 1919.* There is, however, much of interest from an electrical or allied point of view in the other sections of the report, and what follows is an abstract of the more important portions bearing upon the electrical industry.

Dangerous Trades.—Mr. G. Stevenson Taylor, O.B.E., states that the observance of the special rules and regulations for dangerous trades is still below the pre-war standard, but few deliberate evasions have been noted.

Many factories engaged in the electric accumulator industry were worked under considerable pressure during the war, and the large demand for accumulators for use on motor cars and motor cycles has tended to maintain the pressure. Considerable extensions have been made to several factories during the year. In the case of one new factory, which was brought to the notice of the inspector by the notification of several cases of lead poisoning, the occupiers had failed to obtain a copy of the regulations or to comply with them; the firm was fined £10 10s. In several factories where extensions have been made, attempts to utilise the original dust-extraction plant in connection with them have thrown an undue burden on the plant and resulted in a considerable falling off in its efficiency. In other factories the loss of efficiency in the dust-extraction plant has been wholly due to lack of proper maintenance and cleaning. Mr. Clark (West London) mentions a case of this kind where the pasting benches were constructed with grids, and materials falling through them had been allowed to choke the exhaust pipes. The same inspector states that a case of lead poisoning was apparently caused by the worker inhaling the dust produced when the last traces of a lead compound were removed from a shovel by knocking it on the outside of an exhaust hood.

The overloading of cranes is undoubtedly a very common breach of the regulations, but one which is difficult to detect in the absence of definite evidence of the weight of articles lifted. This is often only revealed after a collapse has occurred. Excessive overloading of electric cranes is often made possible by drivers and others removing the proper fuses in the electric circuits and replacing them by heavier ones. This is probably done to save the trouble of frequently renewing the proper fuses, as they burn out with a moderate overload on the crane motors.

In addition to overhead crane rail accidents, Mr. Wright (North-Eastern Division) comments on accidents due to overwinding, and electrical accidents to persons doing repairs or painting in the vicinity of overhead trolley wires. In the Huddersfield district, Mr. Peacock reports on a fatal accident to a man by electric shock. A hoist was electrically controlled, but the wall plugs had become loose, and the descending cage fractured the lock casing and detached the metal conduit carrying the electric cable, with the result that the gate became "alive," and a man received a shock when trying to open it.

The lighting of press shops has an important bearing on accidents; if the natural or artificial light in such shops is inadequate or comes from the wrong direction in relation to any particular press, the operator cannot see clearly what is happening between the dies of the press.

With regard to overspeeding of grindstones and emery wheels, users evidently make mistakes in calculating the velocity, or fail to allow for variation in the speed of the prime mover. Mr. Hird (Bolton), describing a fatal accident due to the fracture of an overspeeded grindstone, mentions that the stone itself was quite sound and properly mounted. It was assumed, however, that the speed of the driving motor was constant, and the fluctuations due to variations in voltage and to heating up had not been appreciated.

A number of unusual explosions are mentioned; Mr. Roos (South-West London) describes one which occurred in a machine for polishing powdered aluminium. The origin of the explosion is difficult to explain, as the machine was earthed, and there should have been no risk of sparking from static charges of electricity such as appear to have given rise to some explosions of this nature.

Sanitation and Lighting.—The keynote of the reports from practically all divisions state Mr. C. F. Wright, O.B.E., and Miss Slocock, is the progress made during the year in getting factories back to their pre-war standard of general cleanliness, and there is a desire on the part of both employers and workers for better hygienic conditions in all classes of work places. With regard to lighting, they state that progress is generally recorded both by means of electricity and gas. Diffused ceiling lighting appears to be coming more and more into vogue, and has certainly great advantage over some other systems of illumination, since, if the lamps are properly placed there is an absence of both glare and shadow. The arc lamp is disappearing, and the gasfilled lamp taking its place. One objection to electric lamps of this type, however, is the glare, but this can be overcome by the use of proper shades—the indirect method of reflection being often adopted. The general

* H.M. Stationery Office, Kingsway, W.C. 2. Cmd. 941; price 1s. 6d. net.

question of shading both electric and incandescent gas lights has received the attention of the staff, and the better adjustment of light to the work is also frequently noted. Mr. Eraut (Belfast) comments on improved illumination in linen weaving sheds and in handkerchief hemming and embroidery work.

"The concentration of light on the cloth being woven is effected by means of carefully shaded electric lamps, whereby the worker is protected from the glare, the reed space is thoroughly illuminated and at the same time sufficient lighting is provided for the gangways. In fine stitching it is obvious that a very efficient system of lighting is essential if the eyes of the workers are not to be strained, and this is being secured by means of lamp shades with a very acute cone angle which concentrates the light on the work immediately under the machine needle, and leaves the worker's face shaded."

Similarly the high degree of accuracy necessary in the work in many of the factories in Coventry and Rugby makes good lighting imperative; there most of the factories are lighted by means of electric lamps, which are either of the arc type and fixed considerably higher than the workers' heads, or of the metal filament type attached to flexible cables, and taken to the machines which are in use, the worker's eyes being protected from glare by the use of adjustable coloured shades of metal or glass, frosted glass, or globes of the "Holophane" type. The introduction of a concentrated form of lighting is reported also in the Norwich boot factories, more particularly at the machine tables where it is now frequently found that the lamps are carried on standards affixed to the tables, and so constructed that the light can be fully directed on the work and shaded to protect the operator's eyes from the glare. These lights are highly spoken of by the workers, who appreciate the absence of eye strain. As an instance of bad lighting, Miss Sanderson refers to the necessity for providing separately for general lighting and the lighting of individual machines or parts of the work.

Industrial Diseases.—Reporting on this subject, Dr. T. M. Legge, M.D., C.B.E., states that detailed investigations by Dr. J. C. Bridge, F.R.C.S., Ed., have been made into, amongst other things, the injurious effects on the eyes and the temporary blindness following exposure to flashes in electric welding.

The industry which stands out as the one exposing workers to the greatest risk of plumbism is that of the manufacture of electric accumulators. Seeing how large is the proportion of the cases occurring in the one operation of pasting (20 out of 48), effort should be directed by manufacturers to accomplishing this by mechanical means. In this country experiments have been made in the past in this direction, but have not proved so successful as would appear to be the case in America, where Dr. Legge found that in the larger works pasting machines are, to some extent, taking the place of hand pasting. Trimming, wire brushing, filing, and lead burning account for nine cases, and where lead burning and wire brushing are done at fixed points exhaust ventilation is imperative. As right notions of the causation of lead poisoning are of first importance, Dr. Legge emphasises again his belief, after perusal of some 25,000 reports on cases which have occurred in the past, that locally applied exhaust ventilation is the sheet-anchor in the protection of the workers from leady dust and fume, and that these alone are the causative agents. In the cases for the past year, for instance, there is a note of one man whose duty it was to whitewash the red lead room, before doing which, however, he "*brushed the red lead off the walls with a stiff broom.*" He had only been employed three months when he contracted lead poisoning. In an electric accumulator factory a man, employed four months only, suffered because "pasted lead plates were being ground off at the edges on an emery wheel with no exhaust ventilation fitted."

With regard to the employment of women and young persons under 18 years of age in lead processes, the International Labour Conference, held at Washington last year, recommended that, in view of the danger involved to the function of maternity and to the physical development of children, women and young persons under the age of 18 years be excluded from employment in mixing and pasting in the manufacture or repair of electric accumulators, and cleaning workrooms where these processes are carried out.

"It is further recommended that the employment of such persons in processes involving the use of lead compounds be permitted only subject to the following conditions: (*a*) Locally applied exhaust ventilation to remove dust and fumes at the point of origin; (*b*) cleanliness of tools and workrooms; (*c*) notification to Government of all cases of lead poisoning and compensation therefor; (*d*) periodic medical examination of persons employed in such processes; (*e*) provision of sufficient and suitable cloakroom, washing, and messroom accommodation, and of special protective clothing; (*f*) prohibition of bringing food or drink into the workrooms."

The following figures refer to accidents due to escape of fumes and gases. Power and suction gas: 1914, 21; 1917, 32; 1918, 21; 1919, 19. Starting suction-gas engines accounted for three cases, escape from tubes and flues for three, and repair to tubes and engines also for three. The one fatal case resulted from the operation of charging the producer plant, the wind blowing the gas into the worker's face. Five women were affected in a polishing shop from the adjoining engine house, where a joint in the exhaust pipe became detached, and the gas travelled through the space around two shaftings. Study of the cases again brings out the necessity for equipment with proper rescue appliances always available and *used by the worker*, the danger of working alone, and the risks often run by rescuers.

Dermatitis from zinc chloride used as a flux was investigated; the condition affected girls employed soldering small parts of flash lamps. Considerable carelessness was observed among the operatives, who took little or no care to prevent splashing; the means provided for washing left much to be desired. Greater care in work, improved washing accommodation, and an ointment applied to the hands prior to work rapidly reduced the number of cases.

Night Employment of Young Persons.—A general survey has been made, says Mr. W. K. Beard, of the position regarding the employment of young persons at night in industries where such employment is permitted. Inquiries have been made in all electrical stations in which it was considered likely that young persons were employed. The exception is used only in a few small to medium-sized stations in the smaller towns. The figures obtained were: Works in which young persons are employed at night, 85; number of young persons employed, 191; employment is practically always on the three-shift system. "Volt lads" regulate the pressure and record meter readings; some do a little more, and are called switchboard attendants. They are found in stations where there is only one engineer on a shift, and assist him. Oilers and cleaners, coal trimmers, and assistant stokers, battery fillers; these boys are not being trained as a rule, and the apprentices work on the day shift only. They are used as cheap labour, and at 18 years of age or thereabouts lose their employment; station engineers do not favour their employment, partly for this reason, and partly because they would prefer more responsible persons.

THE AWARDS OF THE WHITLEY COUNCILS

Colchester Corporation *v.* E.T.U.

The President of the Industrial Court had before him, on October 22nd last, at Westminster, the case of the Colchester Corporation *versus* the Electrical Trades Union, the terms of reference being: "An application from the Electrical Trades Union that the agreed schedule of consolidated rates as fixed by the District Council No. 9 (Home Counties) of the Joint Industrial Council for the Electricity Supply Industry shall be paid to the workpeople concerned employed by the electricity department of the Colchester Corporation."

On behalf of the E.T.U. Mr. W. J. Webb said a Whitley Council had been set up for the electricity supply industry, and Colchester was situated in No. 9 area of that national body. The No. 9 District Council had fixed rates of wages for all the operatives employed in electricity undertakings and generating stations in that area, and had issued instructions to all the undertakings in that area to pay those rates. With the possible exception of two privately-owned concerns and one municipality (Colchester), the fixed rates had been paid by all. Colchester Corporation refused to pay the rates on the plea that it was unable to afford the increases in wages which the fixed rates involved. The majority of the municipal undertakings in the No. 9 area were at present not paying their way; therefore, if Colchester were not made to pay the fixed rates, hardly any of the other municipal undertakings would pay them either, and that would be the end of the Whitley scheme. The Whitley Council was set up to avoid industrial strife, and it was not going to tend to that end if undertakings refused to conform to the decisions of the Council. That was the E.T.U.'s case; it was not interested in whether the Colchester Corporation could afford to pay the rates, it was principally concerned with the prestige of the National Joint Industrial Council. It asked the Court to rule that the rates of wages fixed by the District Councils, or National Joint Industrial Council, should be upheld by the bodies which were parties to those Councils; those bodies were directly represented on the Councils because of their membership of the Incorporated Municipal Electrical Association.

On behalf of the Colchester Corporation it was pointed out that the E.T.U. representative urged nothing so far as he himself was concerned; it was a claim on behalf of the committee he represented. It amounted to opposition on the part of another body which set up certain claims, *inter alia*, that the Court's power was limited to the ruling of "Yea" or "Nay" to the standard rate of pay, and that it had no jurisdiction to judge the case upon its merits. If that claim was upheld by the Court, then it was of no use continuing the case. Unless it could be judged upon its merits, the case would be of no value to the Corporation.

The secretary of No. 9 District Council on the employers' side, Mr. T. W. Cole, called as a witness for the E.T.U., said that the statement he was to make had been agreed to by all the members, both employers and employed, of the Council. As a witness for the E.T.U., he submitted the case of the Home Counties (No. 9 area) Industrial Council, that the Court should decide whether the Colchester Corporation should or should not pay the consolidated rates as laid down by No. 9 Council. Further, he stated that it was of radical im-

portance, not only to his Council, but to all others, that the Court's ruling, if in favour of payment, should specifically state that the rates were not applied on their own merits, but in virtue of their being the standard rates, which were issued for the district by the properly constituted Council for that district. He urged serious consideration of that point, since it would deal a fatal blow at the authority of the whole of the District Councils if a new principle were introduced, namely, that there should exist over the District Councils another tribunal which might alter the various rates which had been fixed by the District Councils. It would mean that in future no Corporation or company would pay the rates recommended by the District Councils until they had been confirmed by an Industrial Court. Further, seeing that the majority of the undertakings in the No. 9 area were paying the consolidated rates solely on the understanding that the District Council was the authority recognised by the Government for fixing those rates, all such undertakings would be placed in an entirely false position. The trade union side would not continue to work on the Council, and it was doubtful whether any representatives would be found willing to act on the employers' side, if their work was made subject to the approval of a further tribunal. The No. 9 Council was recognised by the Ministry of Transport as having a *locus* as a properly constituted body under the Electric Lighting (Clauses) Act, 1899, and the Statutory Undertakings (Temporary Increase of Charges) Act, 1918. Such *locus* was given in view of the fact that certain undertakings, being unable to pay their way, had recourse to the Ministry of Transport for permission to increase their maximum charges for electricity supplied. In such cases the schedule of consolidated rates of wages issued by the No. 9 Council was taken as the authoritative scale, and the Council had been given a locus, in an interview with the Electricity Commissioners, to oppose applications for permission to increase charges for electricity if the undertakings concerned paid rates of wages other than the consolidated ones. The Council, therefore, claimed to be recognised as the final authority for its district on the question of wages by both the Ministry of Labour and the Ministry of Transport.

Following an explanation of how the Colchester Corporation was represented on the District Council by virtue of its membership of the I.M.E.A., and of the Whitley scheme's idea that tariffs agreed to by a majority of both sides of the District Council could be imposed on all constituent bodies in its area without final reference to, or acceptance by them, it was pointed out that if the relationship of the Colchester Corporation to the No. 9 District Council was not upheld, similar relationships in the case of other undertakings could not be upheld either. It was intended that the Councils should be composed only of representatives of the trade unions and employers' associations; the Whitley scheme specifically intended that individual undertakings should not be asked to elect members.

For the Colchester Corporation it was argued that before it could be bound to a tariff the Corporation should have a voice in the arrangement of, or in the appointment of those who arranged, the tariff. It agreed in substance, but disagreed in fact, with the arguments set out above. It was not, and never had been, represented, and always strongly dissented from the whole thing. Although it had been a member of the I.M.E.A. for many years, as soon as that body was called upon to be a party to schemes connected with the payment of wages, the Colchester Corporation had informed it that the Corporation had no desire to be and would dissent from being associated with any action the I.M.E.A. might take. In March, 1919, the Corporation appealed to the Ministry of Transport in connection with the Stoker Award, and the Ministry gave a very definite ruling that it was a mistake for the Corporation to have been cited as a party to that award.

For the No. 9 District Council it was stated that even in the event of the majority of the undertakings throughout the country resigning their membership of the I.M.E.A. (and thus ceasing to be represented on the District Councils), it was the idea of the Whitley scheme that the Joint Industrial Council (if it still existed) should still in that case continue to govern the situation. Rates fixed by a District Council were intended to be paid whether the various undertakings were willing to pay them or not. The employés' side of the Council was prepared to carry out all the Council's decisions, because the employers' side was also expected to abide by them. The Ministry of Transport in sanctioning increased charges for electricity would take into account the undertaking's willingness to pay higher rates of wages if the fact was mentioned in its application, but not otherwise.

Colchester Corporation *v.* E.P.E.A.

The application of the Electrical Power Engineers' Association for the payment of a bonus of £30 per annum as from January 1st, 1920, to the technical engineering staff of the Colchester Corporation was next heard by the Court. The recommendation to pay the bonus was made by the National Joint Board of Employers and Members of Staffs in February last, subsequent and in addition to the Stoker Award No. 9,281.

The Colchester Corporation maintained the same attitude as it had done in connection with the previous case, namely, that it was not a party to the award.

The decision of the Court will be issued in due course.

TRADE STATISTICS OF SOUTH AFRICA.

The following statement, showing the imports of electrical and similar goods into the Union of South Africa during the year 1919, has been taken from the recently-issued official trade statistics. Where possible the figures for 1918 are added for purposes of comparison, and notes of any increases or decreases are made, but in some instances new classifications prevent this being done:—

	1918 £	1919 £	Inc. or Dec. £
Electrical cable and wire.—			
Total	90,000	272,000	+182,000
From Great Britain	20,000	182,000	+162,000
,, Japan	34,000	25,000	− 9,000
,, United States	32,000	62,000	+ 30,000
Batteries, Primary.—			
Total		17,000	—
From Great Britain	*	2,000	—
,, United States		14,700	—
Batteries, secondary.—			
Total		63,000	—
From Great Britain	*	11,000	—
,, United States		52,000	—
Heating and cooking apparatus.—			
Total		24,000	—
From Great Britain	*	10,000	—
,, United States		14,000	—
Insulators, porcelain.—			
Total	2,000	4,000	+ 2,000
From Great Britain	1,000	3,700	+ 2,700
Insulators, all other.—			
Total	325	500	+ 75
From Great Britain	85	350	+ 265
Lamps, incandescent.—			
Total		94,000	—
From Great Britain		16,000	—
,, Holland	*	28,500	—
,, United States		47,000	—
Motors.—			
Total, KW.	*	15,000	—
£	*	95,000	—
From Great Britain, KW. ...		8,200	—
£		49,000	—
,, United States, KW. ...		6,770	—
£		45,000	—
Transformers.—			
Total	*	17,000	—
From Great Britain		4,600	—
,, United States		12,000	—
Electrical machinery, other.—			
Total	126,000†	180,000	+ 54,000
From Great Britain	56,000	62,000	+ 6,000
,, United States	69,000	117,000	+ 48,000
Electrical material, other.—			
Total	282,000‡	195,000	− 87,000
From Great Britain	81,000	120,000	+ 39,000
,, United States	79,000	64,000	− 15,000
,, Japan	24,000	9,000	− 15,000
,, Holland	95,000	500	− 94,500
Cranes, elevators, and lifts.—			
Total	11,000	20,000	+ 9,000
From Great Britain	8,000	14,000	+ 6,000
,, United States	3,000	6,000	+ 3,000
Mining machinery.—			
Total	569,000	715,000	+142,000
From Great Britain	292,000	303,000	+ 11,000
,, Sweden	4,000	1,000	− 3,000
,, United States	272,000	406,000	+134,000
,, Switzerland	1,000	1,000	—
Telegraph and telephone material.—			
Total	6,000	17,000	+ 11,000
From Great Britain	2,000	8,000	+ 6,000
,, Sweden	3,000	1,500	− 1,500
Tramway rails.—			
Total	1,000	4,500	+ 3,500
From Great Britain	1,000	1,500	+ 500
,, United States	—	3,000	+ 3,000
Tramway rolling-stock.—			
Total	7,000	29,000	+ 22,000
From Great Britain	4,000	10,000	+ 6,000
,, United States	3,000	19,000	+ 16,000
Other tramway materials.—			
Total	1,000	7,500	+ 6,500
From Great Britain	—	1,500	+ 1,500
,, United States	1,000	—	− 1,000
,, Other countries	—	6,000	+ 6,000

In addition to the above the following goods were imported as "Government stores":—

	1918	1919	Inc. or Dec.
	£	£	£
Batteries, primary.—			
From Great Britain	*	6,000	—
,, United States		11,000	—
Batteries, secondary.—			
From Great Britain	*	1,000	—
Heating and cooking apparatus.—			
From Great Britain	*	1,000	—
Insulators, porcelain.—			
From Great Britain	*	4,000	—
Motors and parts.—			
From Great Britain, KW.		67	—
£	*	1,114	—
Electrical cable and wire.—			
Total	14,000	99,500	+ 85,500
From United Kingdom	11,000	84,000	+ 73,000
,, United States	—	15,500	+ 15,500
Telegraph and telephone material.—			
Total	13,000	78,000	+ 65,000
From United Kingdom	9,000	59,000	+ 50,000
,, Sweden	4,000	9,000	+ 5,000
,, United States	—	10,000	+ 10,000
Transformers.—			
From Great Britain		137	
Electrical machinery, other.—			
From Great Britain		1,500	
,, United States		400	
Electrical material, other.—			
From Great Britain		3,000	

* Included with electrical material, other.
† Includes motors and transformers, now shown separately.
‡ Includes batteries, lamps, heating and cooking apparatus, &c., now shown separately.

NEW PATENTS APPLIED FOR, 1920.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

30,074. "Electric coupling." I. Lubbock. October 25th.
30,109. "Circuit closing and breaking devices." E. Bouteille. October 25th. (France, November 26th, 1919.)
30,121. "Electric relays." McKenzie, Holland, and Westinghouse Power Signal Co., and W. A. Pearce. October 25th.
30,122. "Electro-pneumatic braking apparatus." T. H. Thomas. October 25th. (United States, April 2nd.)
30,133. "Relays for control of electric circuits." Igranic Electric Co. and C. W. Yerger. October 25th.
30,135. "Electrically driven planers, &c." Metropolitan-Vickers Electrical Co. and L. Miller. October 25th.
30,148. "Luminous electric discharge tubes for production of illuminated signs, &c." M. Schmierer. October 25th. (Germany, October 25th, 1919.)
30,156. "Magnetic circuit of electrical motors and dynamos." H. Robinson. October 25th.
30,167. "Electric flame projector." C. W. Richardson. October 25th.
30,193. "Electro-magnetic signalling device for automobiles, &c." G. M. O. Richards. October 26th.
30,216. "Electric installations for starting and lighting automobiles." J. Bethenod. October 26th. (France, October 21st, 1919.)
30,227. "Electric generator." S. Gross. October 26th.
30,230. "Appliance for actuating handle, &c., of electric switches from a distance." E. M. Stancliffe. October 26th.
30,231. "Transmitting and receiving instruments." W. Stroud, A. Barr, and Barr & Stroud. October 26th.
30,265. "Electrode holders for electric arc welding, &c." A. C. Cutting and Welding Co., W. H. Flood, and D. T. Smout. October 26th.
30,267. "Secondary electric batteries." Chloride Electrical Storage Co. and H. Dean. October 26th.
30,278. "Magneto electric machines." A. M. Allan and R. B. North. October 26th.
30,287. "Wind power electric generating plant." J. C. Hansen-Ellehammer. October 26th.
30,290. "Cable telegraphy." S. G. Brown. October 26th.
30,292. "X-ray plates." A. L. Landau and L. A. Levy. October 26th.
30,301. "Three-electrode thermionic vacuum tubes." W. H. Eccles. October 26th.
30,305. "Wireless telephone transmitters." Ges. für Drahtlose Telegraphie. October 26th. (Germany, November 11th, 1919.)
30,306. "Process of telephony and telegraphy by high-frequency currents and stationary periodicity transformers." Ges. für Drahtlose Telegraphie. October 26th. (Germany, December 2nd, 1919.)
30,307. "High frequency interrupters." Ges. für Drahtlose Telegraphie. October 26th. (Germany, November 7th, 1919.)
30,313. "Telephones." P. E. Davenport. October 27th.
30,380. "Electric fan heaters." A. E. Alexander (Universal Interests Inc.) and Universal Interests Inc. October 27th.
30,388. "Relay for signalling." W. Ges. Gurlt. October 27th. (Germany, November 24th, 1919.)
30,389. "Systems of electric motor control." British Thomson-Houston Co. (General Electric Co.) and General Electric Co. October 27th.
30,396. "Electrical signalling apparatus." Luftfahrzeugbau Schütte-Lanz and S. Sokal (Luftfahrzeugbau Schütte-Lanz). October 27th.
30,400. "Electrical cooking vessels." G. Durando. October 27th. (Italy, November 20th, 1919.)
30,425. "Dynamo electric machines." J. B. Wiard. October 27th.
30,432. "Sparking plugs." Brewster-Goldsmith Corporation. October 27th. (United States, June 9th, 1919.)
30,433. "Electric means for preventing theft of motor vehicles." J. M. Longe and O. T. Smith. October 27th.
30,434. "Electric switches." J. M. Longe and O. T. Smith. October 27th.
30,458. "Long range electric switch." A. Page. October 28th.
30,465. "Electro-magnetic control mechanism." S. Grossi. October 28th.
30,473. "Automatic electric switches." H. B. Vogel. October 28th.
30,504. "Vacuum tubes for wireless telegraphy and telephony." Soc. Independante de Telegraphie sans Fils. October 28th. (France, October 28th, 1919.)
30,534. "Electrode for arc welding, &c." W. H. Boorne. October 29th.
30,544. "Indicator for storage batteries." C. C. Hewitt. October 28th.
30,552. "Drawn wire filaments." General Electric Co. and F. S. Goucher. October 28th.
30,569. "Dynamo and switchboard for motor vehicles." H. T. Collier, H. B. Elcock, and J. J. Milne. October 29th.
30,576. "Modulation of electrical oscillations, &c." Radio Communication Co. and J. Scott-Taggart. October 29th.
30,597. "Electric rivet heater." W. S. Johnson and J. W. Sheffer. October 29th.
30,599. "Means for interlocking electric switches." C. C. Garrard and A. H. Railing. October 29th.
30,605. "Microphones." J. Gardner. October 29th.
30,628. "Electrical transmission of intelligence." F. E. Pernat and E. Potter (Pernat & Rich), and L. J. Rich. October 29th.
30,631. "Apparatus for electrically transmitting images of pictures, moving objects, &c., to a distance." F. S. Morgan. October 29th.
30,638. "Electric heating and cooking apparatus." B. G. Battson. October 29th.
30,685. "Suspension chains for electroliers, &c." E. J. Perry. October 30th.
30,690. "Tramcars, &c." S. Geddis. October 30th.
30,702. "Magnetic circuits for electro-magnetic apparatus." T. F. Wall. October 30th.
30,706. "Telegraph relays." A. Orling and Orling's Telegraph Instruments Syndicate. October 30th.
30,737. "Electric insulators." S. de la Rue and T. de la Rue & Co. October 30th.
30,740. "Electric light, gas, &c., fittings." E. Eyre and W. Harrison. October 30th.
30,743. "Radio apparatus." T. Appleby and L. M. Knoll. October 30th. (United States, June 14th, 1919.)

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1915.

244. "Electric resistances." H. George and J. Hebert. April 10th, 1917. (115,617.)

1919.

8,156. "Telemotors." A. E. Alexander (Benson Electric Co.). April 1st, 1919. (152,045.)
8,157. "Telemotors." A. E. Alexander (Benson Electric Co.). April 1st, 1919. (152,046.)
8,158. "Telemotors." A. E. Alexander (Benson Electric Co.). April 1st, 1919. (152,047.)
9,489. "Electrical deposition of particles from gases." Sir O. Lodge, L. Lodge, and Lodge Fume Deposit Co. (in liquidation). April 14th, 1919. (152,051.)
9,511. "Electric heating resistance elements." L. V. Leonard. April 14th, 1919. (152,052.)
11,397. "Electric incandescence lamps." F. Harrison. May 7th, 1919. (152,058.)
14,073. "Electric fuses." H. Harris and J. G. Cook. June 4th, 1919. (152,062.)
14,205. "Electric selective signalling and like systems." International Electric Co. and F. R. Baldock. June 4th, 1919. (152,063.)
16,538. "Dynamo-electric machines." British Electric Plant Co. and A. W. Maudling. July 2nd, 1919. (152,076.)
16,674. "Apparatus for electric step-by-step signalling systems." H. C. Ford. July 3rd, 1918. (129,290.)
16,691. "Thermionic amplifiers." J. Erskine-Murray. July 3rd, 1919. (152,086.)
16,751. "Electric burglar alarm." T. B. O'Brien. July 4th, 1919. (152,098.)
16,828. "Intercommunication telephones." R. L. Murray and Telephone Manufacturing Co. July 4th, 1919. (152,107.)
17,345. "Electrical transmission systems for use in speed controlling, measuring, and/or indicating in signalling by speed variation and for analogous purposes." Evershed & Vignoles and J. C. Needham. June 10th, 1919. (152,128.)
17,365. "Electric ignition apparatus for internal combustion engines." A. J. Stevens & Co. and H. Stevens. July 11th, 1919. (152,131.)
18,016. "Electric furnaces." Electro-Metals, Ltd., and T. D. Robertson. July 18th, 1919. (152,145.)
18,410. "Apparatus for use in connection with telegraphy and telephony and in connection with the control of electrically actuated or controlled apparatus situated at a distance." A. H. Branton, E. A. Bitton, A. W. Dransfield, and S. E. Boyce. July 24th, 1919. (Cognate application 31,511/19.) (152,153.)
18,462. "Electric switch lock." W. H. Cole. July 24th, 1919. (152,155.)
19,571. "Induction electric furnaces." British Thomson-Houston Co. (General Electric Co.). August 8th, 1919. (152,157.)
19,845. "Electric heaters." R. Hill. August 12th, 1919. (152,162.)
20,114. "High-voltage insulators." F. Jaentsch. February 6th, 1919. (138,589.)
21,342. "Electric arc furnaces." A. P. Heyen. August 30th, 1919. (152,176.)
23,406. "Telegraphic recorders, relays, telephonic receivers, or the like." J. H. Smart and J. Tucker. September 23rd, 1919. (152,190.)
26,267. "Junction or like device for use in electrical wiring systems." E. Wilcox. October 27th, 1919. (152,210.)
27,570. "Electrically-controlled application valves for pneumatic brakes." R. Haddan (J. B. Regan). November 7th, 1919. (152,216.)
29,280. "Conductor rails for electric railways or the like." Merz and McLellan and S. G. Redman. November 24th, 1919. (152,230.)
29,933. "Electric lamp shade holder." J. A. Sargent. December 1st, 1919. (152,234.)

1920.

675. "Electric heating units." British Thomson-Houston Co. (General Electric Co.). January 8th, 1920. (152,248.)
3,162. "Spark plug." W. C. Rollins. February 2nd, 1920. (152,256.)
3,312. "Electrodes for electric arc welding and metal-cutting purposes." W. H. Boorne. February 3rd, 1920. (Addition to 132,354.) (152,257.)
4,970. "Electric signalling systems." Igranic Electric Co. (Cutler Hammer Manufacturing Co.). February 18th, 1920. (152,262.)
5,585. "Electric switches." Benjamin Electric Manufacturing Co. December 26th, 1914. (139,484.)
7,714. "Sparking plugs for internal combustion engines." R. Breton. October 16th, 1919. (152,270.)
8,245. "Electric transformers." Western Electric Co. November 15th, 1917. (140,466.)
8,587. "Induction regulators particularly for varying the voltage of electric transformers." V. Martinetto. February 21st, 1919. (140,782.)
13,071. "Telephone systems." Western Electric Co. September 10th, 1919. (Addition to 144,264.) (150,727.)
18,028. "System of connections for regulating the strength of a current in the divisions of a two-part divided current circuits." Krupp Akt.-Ges. F. January 2nd, 1917. (145,730.)